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McIntosh & Seymour Corporation,
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McINTOSH & SEYMOUR MOTOR SHIPS

DEC., 1927

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Motorship

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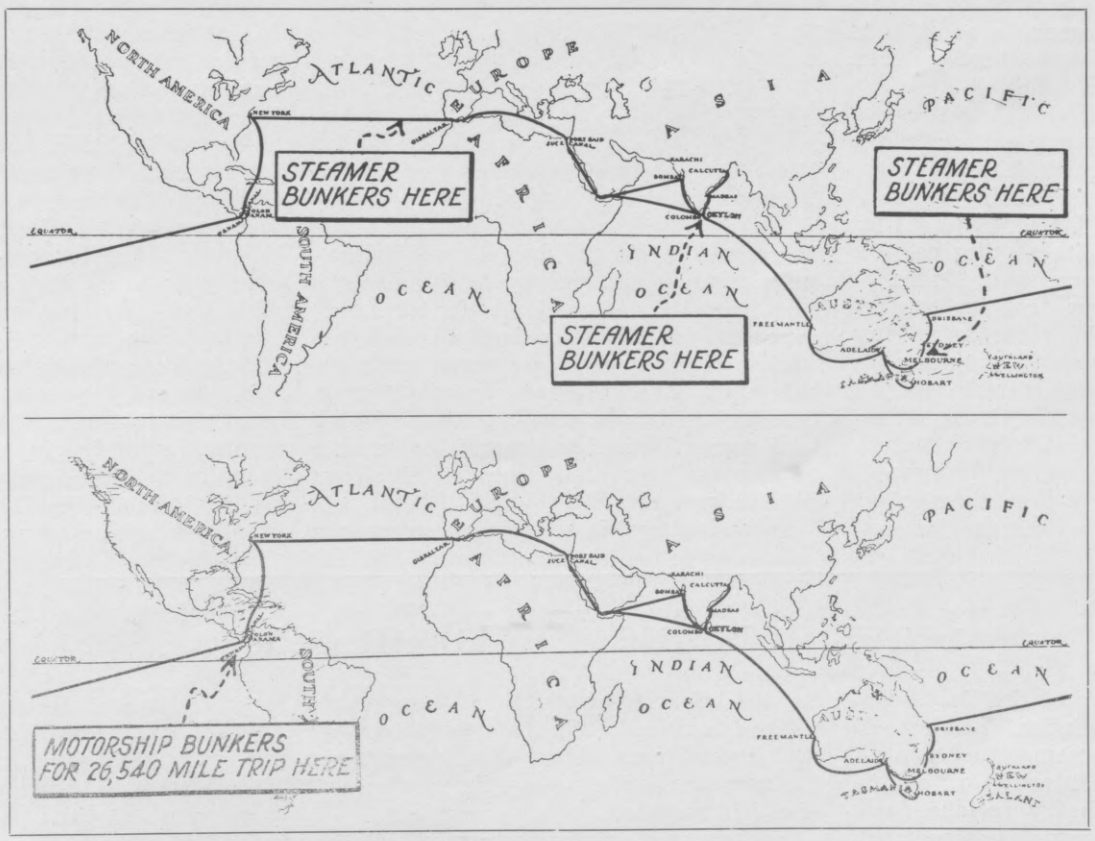
Volume XII December, 1927 *Number* 12

Pulverized Coal Firing Shows Superlative Economies of the Marine Diesel*

Analysis of Steam's Latest Improvement Throws Into Sharp Relief the Great Economy, Amounting to Over $10,000 Per Voyage, With Which the Motorship Can Operate

MUCH publicity has been given to the question of pulverized firing. Some steam enthusiasts have even gone so far as to claim that they have at last something to offer to the shipowner as attractive as the Diesel. Pulverized coal plant is more efficient than the old hand-fired coal burner because it virtually turns coal into a liquid fuel and may thus bring the steamer into the same economic category as that occupied by the oil burner. But, instead of releasing valuable space for freight carrying as any oil using plant does, it increases nonproductive space as the diagram shows. It does not cut down bunkering time, neither does it increase speed or radius of action. The Diesel engine, on the other hand, occupies minimum space and permits of maximum maneuverability and greater speed at minimum cost.



Disadvantages of Pulverized Coal, compared with oil, are well shown on this round-the-world 26,540 mile fast freight route chart. The steamer is at a hopeless disadvantage for bunkering

The Shipping Board's necessary realization of these basic facts make it difficult to grasp the motives behind the fitting of pulverized coal firing apparatus to the boilers of the freighter MERCER. At the worst, we can think of the Board as having retrogressive ideas—which is obviously incorrect. At the best, we can credit them with a real desire to determine upon an improvement of efficiency in an admittedly inefficient power producing plant, the Scotch boiler and marine steam prime mover—reciprocator or turbine. No pretensions are made of serious rivalry to the marine Diesel installation—such would be a difficult task to essay. Rather the idea seems to have at its back a genuine attempt to improve the flexibility and economy of existing steam using ships. It is a perfectly reasonable development and one which the engineering world will watch with great interest, feeling at the same time, that here is another propulsive choice to be made. Furthermore, it is claimed that it widens the range of coals which can be employed and does not necessarily limit a ship to bunkering at ports known to have good coal for steam raising.

The plant installed for operation in the MERCER appears to take up considerable space which would otherwise be available for the carriage of freight. The MERCER is a 3000 hp. ship, and this makes it unpleasant to contemplate the size of plant necessary, if the scheme were even desirable, for a large ship. In all justice, however, it must be argued that the MERCER'S plant does not by any means represent finality because this ship may be regarded at present merely as a floating laboratory.

In any case, pulverizing plant is bound to absorb space otherwise available for freight. Someone has estimated for a ship of the size of the MERCER a space equal to about 100 tons of bunker space or about 4000 cu. ft. in addition to the large space already taken up by bunkers. The coal of course comes aboard in lumps just as though it were going to be hand fired. In other words all the old evils of the coal burning ship which the modern progressive shipowner is endeavoring to escape by using Diesels,

*See also MOTORSHIP, May, 1927, p. 373, and July, 1927, p. 524, for previous comments.

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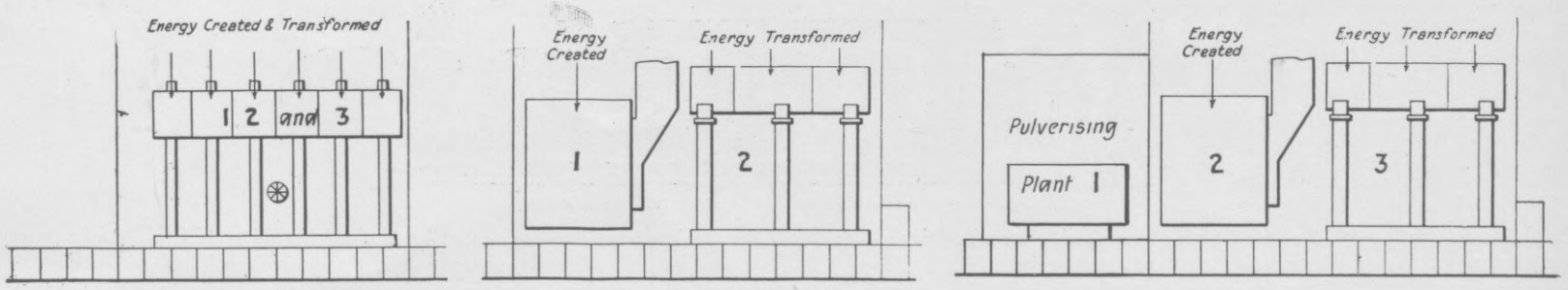


From A. C. Hardy's "Motorships."

Diagrams show that the Diesel does in one operation what the coal burning steam engine does in two and the pulverized coal steam layout in three operations. The coal burning steamer carries fuel in the freight space, the motorship in the double bottom

are present. Just figure out what this means, by considering two 10,000 d.w. cargo ships one having coal burning boilers and reciprocating engines and the other having a modern Diesel.

The steamer with a 9-10 knot speed will burn roughly 47 tons of coal per day.

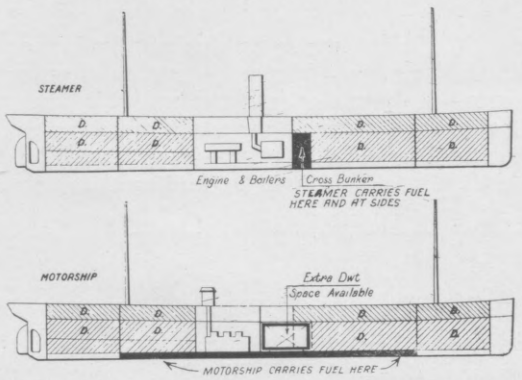
The motorship with a 13 knot speed will burn roughly 13 tons of fuel oil per day for all purposes.

On a 20-day voyage, the steamer will consume, therefore, around 940 tons in all which must be carried in cross and side bunkers.

On a 20-day voyage, the motorship will consume about 260 tons of oil fuel which is carried in the double bottoms and which absorbs, therefore, no valuable freight space.

The motorship, therefore, has the advantage—assuming the same hull dimensions—of earning per voyage well over $10,000 more than the steamer, in addition to which the motorship gets there quicker, and the 20-day voyage wouldn't be a 20-day voyage at all, and the motorship delivers the cargo in better condition. Even if the Diesel engine costs more than the steam engine, as it unquestionably does, and even if the fuel for the former has a higher price than the latter, it is quite easy to see how soon the shipowner gets his money back. It is really time that we stopped talking or thinking about the extra first cost of the Diesel. Doesn't the automobile cost more to possess, and more to operate than the horse and buggy? But would anyone today use the latter?

Pulverized coal may conceivably increase the efficiency at which the steam plant works or rather it may decrease the consumption figure to a point at which it is capable of competing successfully with an oil burning plant. It may, therefore, decrease the bunker and even the boiler space required, but would this decrease not be nullified by the space required by the pulverizing plant? But neither by coal nor oil burning even with high pressures and high superheat (incidentally we heard of a high pressure boiler bursting and causing loss of life recently) can a steam unit hope to approach the economy of the Diesel. The Diesel does in one operation what the steam plant does in two, and does it more economically. You create energy in a boiler and transform it in the reciprocating or rotary prime mover. With pulverized coal you subject your source of energy to treatment before you start to extract energy from it. In other words, you have to use some of the total energy created to generate pre-energy to pulverize your coal. This is well shown in the diagram.



Motorships stow freight where steamers stow coal and pulverizing plant

Pulverized coal is a dirty type of energy creator. The fine dust into which it is ground before being blown into the furnaces seems to find its way unexpectedly and unpleasantly into all odd corners of the ship. The stack has a habit of raining fine coal dust, at times, down on to the deck. At times, also, the smoke discharge from the stack is heavy. This, however, is not continuous and has often been outrivalled by oil burning steamers. Considerations of this nature would, nevertheless, appear to rule out its use on high class passenger carrying ships.

Pulverized coal firing presents no attractions from the point of view of bunkering. Remember that it was solely the fact that the Shipping Board motorships could take on enough fuel at Panama to carry them back to New York again via Australian and Indian ports and the Suez Canal which lead to the supersession of two steamer services, one to India via Suez and the other to Australia via Panama, by one motorship service moving westward all the time and bunkering once. Steamers in such a service would need to bunker at Newport News, at Newcastle, N.S.W., and at an Indian port and probably again at the Azores. Isn't that just like the old stage coach having to change horses all along the road?

Pulverized coal represents a praiseworthy attempt to bring the old into line with the new, and for those owners who through financial weakness or short-sightedness—the two generally go hand in hand—cannot think beyond first cost there will be many attractive features. The real progressive man will scarcely give the matter a second thought, not, we fear, from any partisan feeling towards the Diesel, but merely on a cold dollars-and-cents basis.

Heavy Residue Fuels for Diesels

AT a recent meeting of the Diesel Engine Users Association, London, E. L. Bass in discussing fuel experiments in a mechanical injection oil engine said that the use of heavy residue fuels in oil engines was of paramount importance to those responsible for their operation. In practically all parts of the world there was an appreciable difference in cost between residue fuels and distillates. Actually in some localities the disparity in cost was so great as to prohibit the use of distillates in oil engines for economical running.

The engine on which the particular experiments referred to in the paper had been carried out was a cold-starting engine of the horizontal type working on a four-stroke cycle. It was belt coupled to a dynamo, the efficiency of which had been previously determined. The energy output of the engine was absorbed in resistance frames, the load control being by means of a field rheostat.

One of the chief physical characteristics of fuels controlling their suitability for heavy-oil engines was viscosity. The use of high viscosity fuels involved the preheating of them to reduce the viscosity sufficiently to enable the fuel pumps and atomisers to work efficiently on an engine of any particular type.

In connection with the use of the centrifuge, the author found that in cases of fuels abnormal in respect of their proportion or nature of suspended foreign matter, there was a material advantage to be gained by centrifuging. He also gave as his opinion that with normal Diesel fuels and those containing even up to 0.05 per cent of ash, there was no evidence that any advantage would accrue by the use of the centrifuge in so far as the performance of the engine was concerned.

On the question of blending heavy residue fuels with distillates for use on heavy-oil engines, the limiting factor controlling the quantity of distillate necessary to produce a commercially suitable Diesel fuel from a heavy residue was that where the viscosity of the fuel was sufficiently reduced to give good combustion over a wide load range and yet did not require preheating to a temperature too close to that at which vapor locks occurred.

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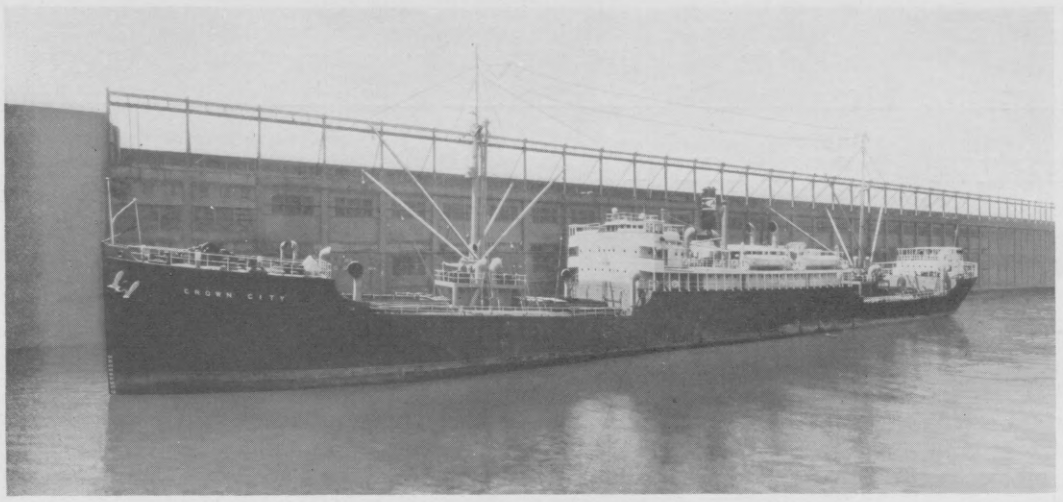
The U. S. Shipping Board and a Permanent Mercantile Marine

MUCH attention is now being directed towards the provision of some constructive action to establish a permanent American Mercantile Marine. Speeches have been made, letters written, suggestions and counter-suggestions voiced, some of which have been practical and some as impracticable as they were uninformed. All are agreed, however, that the American Mercantile Marine cannot hope to operate on the high seas with success in competition with foreign owned mercantile vessels unless some form of financial assistance, such as MOTORSHIP has consistently urged be given to American ships and shipping.

Many people who favor the abolition of government ownership and to whom the idea of government ownership is synonymous with the feeling of government mismanagement have suggested that the solution lies in a subsidy. But, as Senator Copeland pointed out in a constructive speech at the recent Banquet of the Society of Naval Architects and Marine Engineers, the idea of a subsidy seems to be distasteful to many people. If the U. S. government gets out of the shipping business such a subsidy will necessarily have to be given to private shipowners, and since private shipping in the United States operates roughly only 20 per cent of the sea-going tonnage of the country, it is evident that "Private Shipping" will have to be brought into existence. We are so accustomed to hear this talk about the government getting out of the shipping business and handing over its duties to private shipping that we feel inclined to become introspective and to inquire,—Where is Private Shipping?

This is a point of no little import.

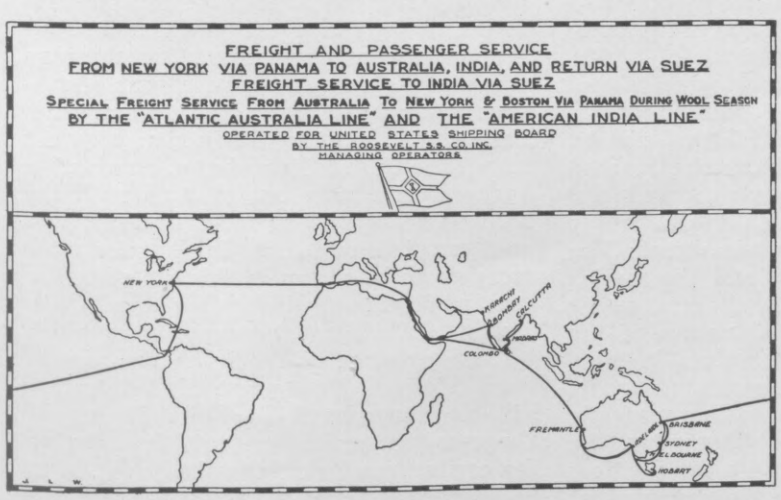


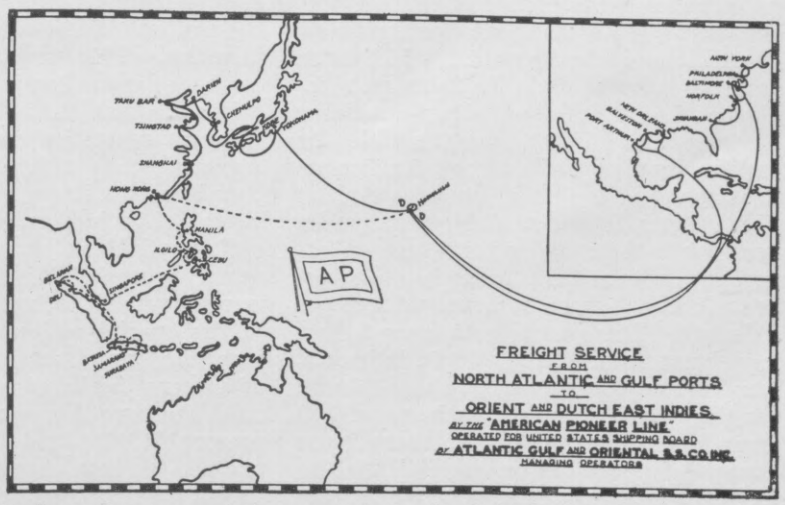
Motorships like the well equipped and engined Crown City are economical high seas' carriers

With the exception of the Grace Line, the Dollar Line, the United Fruit Company and one or two other similar companies, there is no private shipping in the United States other than that which is operated coastwise and which must of necessity be private shipping. The "private shipper" of the United States prefers to operate foreign-owned and foreign flag ships, and a very elementary knowledge of economics is required to discover why he does so. There is no disguising the fact that the American people are not shipminded and that, while theoretically the idea of a mercantile marine appeals to their imagination, practically the steps which require to be taken to create such a mercantile marine are neither understood nor appreciated.

In the last analysis, in all matters connected with sea transportation, it is the man who does things and gets the business who carries the cargoes, and from this point of view it is impossible to gainsay the fact that the Shipping Board is the only active agent furthering an American Mercantile Marine at the present day. An analysis of services shows that all parts of the world are touched by vessels owned and operated by the Board. This includes no less than 41 separate freight and passenger routes to parts of the world as widely separated as Stockholm, and Santa Fe, Copenhagen and Colombo, Manila and Marseilles. Enemies of the Board will contend that these services are not competing, and cannot compete, financially with foreign owned ships. In other words, that they are operated at a loss. This may be so, but remember that the Board is operating with obsolescent tonnage and that, with the exception of the modernized Diesel-engined vessels now in service, there is not a Shipping Board freighter in service designed for post-war cargo shipping conditions. The Shipping Board is doing very well with the material at its disposal. Furthermore, it is deliberately modernizing as much tonnage as possible by the fitting of Diesel engines and will continue this good work with vigor. This is definite, useful, and constructive work.

An 11-knot Diesel-driven cargo vessel is considerably superior in operating efficiency and in money-making potentialities to a 10-knot steamer, and the Dieselized vessels of the Shipping Board are at present doing sterling service on the Australia-India Line and now on the American Pioneer Line running from North Atlantic ports to the Far East. By Dieselizing the Australia-India Line the Shipping Board has converted two distinct steamer services into one round-the-world motorship service. This service is operating very economically because the ships on it only need to bunker once throughout their whole round-the-world passage; namely at Panama. No steamers in existence could make such a trip even under Shipping Board con-


FREIGHT AND PASSENGER SERVICE
FROM NEW YORK VIA PANAMA TO AUSTRALIA, INDIA, AND RETURN VIA SUEZ
FREIGHT SERVICE TO INDIA VIA SUEZ
SPECIAL FREIGHT SERVICE FROM AUSTRALIA TO NEW YORK & BOSTON VIA PANAMA DURING WOOL SEASON
BY THE "ATLANTIC AUSTRALIA LINE" AND THE "AMERICAN INDIA LINE"
OPERATED FOR UNITED STATES SHIPPING BOARD
BY THE ROOSEVELT S.S. CO. INC.
MANAGING OPERATORS
NEW YORK
COLOMBO
FREMANTLE
BRISBANE
SYDNEY
MELBOURNE
HOBART



U. S. Shipping Board motorships have revolutionized Australia-India trade and are now being routed to the Orient and Dutch E. Indies

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ditions. The gradual Dieselization of the American Pioneer Line operating to the Far East will place that service on a modern footing.

Dieselization of all Shipping Board operated services will, in our opinion, gradually turn these services into definite paying concerns and then if it is still necessary for the Board to get out of the business, they will have created something which they can hand over to private shipping when such has been created, and private shipping will possibly be more inclined to buy. Indeed owners will feel that they are getting something for their money upon which they in turn can earn dividends.

In a smaller way Australia, whose shipping problems, as we have many times pointed out, are similar to those of the United States, is going through the same troubles. The end of the war found her with a surplus of government owned tonnage which was operating at a loss, not through any fault of government ownership but largely owing to rude, economic facts and labor restrictions which make it impossible for Australian-operated ships to compete with foreign ships on the high seas. Canada has likewise found herself saddled with a government merchant marine, and this is not operating at a profit, but the mercantile marine situation in both these sections of the British Empire is not so acute naturally, as it is with America, and although Scandinavia and Great Britain are today doing the majority of ocean-carrying work for this country, there is no reason why this majority should not be lowered if genuine monetary aid is given to bridge the difference in operating costs between American-owned and foreign-owned ships.

At the present time the Shipping Board is definitely helping to bridge the difference. If it continues its Dieselization programs, and if it takes existing services one by one, and by converting the ship to Diesel power, modernizes the whole fleet, it will considerably reduce the amount of money required to equalize operation between American and foreign owned ships. Furthermore, it will provide much needed work for the sorely-tried shipbuilding industry in this country. Whichever may or may not be the correct future proceeding with regard to government ownership of shipping, at the present time it marks the only constructive step in the direction of an American merchant marine and as such it should be supported to the full.

Imperative Need for Protection to Yacht Industry

EARLY last Spring, MOTORSHIP, realizing the disparity between the cost of building and equipping yachts in the United States and in foreign countries and shipyards, went to Washington and laid the facts before leading Senators and other officials in a series of interviews. We enlisted their co-operation with a view to giving the American yacht building and equipping industry the protection which it both needs and is entitled to.

This protection is logical, moreover, because although industries, such as the automobile industry, are fully protected by the imposition of customs duties on every car of foreign make which enters the country, the yacht building industry and the engine building industry which runs alongside it has no similar protection. The whole situation represents an anomaly, and an anomaly moreover which has been in existence for so long that its existence is becoming in serious danger of getting taken for granted.

The power driven vessel has had a prime influence in calling peoples' attention to the present state of affairs, as we shall see. By power driven vessel, we mean primarily that thorn in the side of conservatism and "laissez-faire"—the Diesel engine.

Sea transportation is in some ways noteworthy for the number of anomalies contained in the laws governing its administration and operation. That is because sea laws change their character but slowly. When they are formed, one particular set of conditions is in operation which later completely alters. But the laws remain.

Hence the most outstanding anomalies at the present day is to be found in the question of yachts built abroad for American owners. The law is so arranged at present that, although the ship is virtually imported into the country just as one might import an automobile, there is no direct import duty but merely an annual tax per foot length. This amounts to some $2 per foot on boats from 32 ft. to 50 ft. in length, $4 per foot on boats from 50 ft. to 100 ft. in length, and $8 per foot on boats of 100 ft. length and over. Further there is no customs duty leviable on any of the interior fitments or furnishings of the vessel. So that virtually the owner can import into the United States a house load of good expensive furniture and equipment duty free. Ships so built cannot actually operate under the American flag but are classed as documented (not registered) vessels and fly the American yacht flag.

MOTORSHIP foresaw something of the consequences of this state of affairs many months ago and took up the matter with the Department of Commerce as we have mentioned.

Now, further attention has recently been directed to the question by the statement and suggestions of Henry R. Sutphen, president of the National Association of Engine and Boat Manufacturers before the Committee of Ways and Means. Mr. Sutphen estimates that the number of boats now building in foreign countries is 21 and that the cost is estimated to be $3,700,000 as against a probable cost of $5,000,000 in the United States.

The total number of yachts constructed in foreign countries and used in American waters is estimated to be 59 with a total foreign value of $4,000,000, whereas the total value of the ships were constructed in the United States would be $6,000,000. Mr. Sutphen has asked that the tax be increased 10 times the scale mentioned above.

Curiously enough it is to a great extent the Diesel-driven yacht which has done much to precipitate matters in connection with this yacht duty or tax. A wealthy New Yorker bought a steam yacht across the Atlantic from the Clyde in the early 'nineties. This was something of a feat in those days. Possibly it was such a considerable feat that the likelihood of its frequent repetition was considered remote. Anyhow when this steam yacht reached New York the Revenue people charged duty on the ship just as though she were any ordinary dutiable article made abroad. The owner protested the duty and the matter went to the Supreme Court where, owing to the special and unusual nature of the case, the import duty was waived in favor of a users tax based on the ship's tonnage.

At the time this seemed to be a perfectly reasonable idea and even later when the tax per ton was changed to a tax per foot length it seemed logical on the grounds that there might be a few more special cases—but only a few. Who could foresee the amazing development in motor yachting which would take place within recent years? Who could foretell that American owned yachts would be making round the world passages as a matter of ordinary routine?

At the time of writing the economies of the Diesel are giving to large scale yachting an impetus undreamed of a few years ago. Many of the largest and best motoryachts are American owned but at the present time the owner of a yacht can build whereever he pleases. If he imports a foreign built automobile he pays 45 per cent ad valorem duty, but if he imports a foreign built yacht he pays a paltry $8 per foot run. This means that although the flourishing automobile industry is protected to the full by tariff regulations, the shipbuilding and the Diesel engine industry gets practically no help at all.

This is a state of affairs which cannot be allowed to remain. American shipyards build good yachts—one of the largest in the world is now completing at Wilmington; there are many excellent domestic engines to put in them. Engines and ships are logically entitled to full protection.

We are strongly in favor of complete ventilation of the whole matter with a view to securing an adjustment of the existing state of affairs, and the substitution of a duty for the present tax.

Perhaps, taking a long view, such ventilation may even be responsible for the promotion of agitation for revision and alteration of a number of existing shipping laws whose obsolescence the advent of motorshipping has thrown into prominence. Many of the existing navigation laws not only of the United States but of many other countries are sadly out of tune with the progressive spirit of modern times and need complete revision. In America what promises to be a step in this direction has been made already in the proposed Codification of the Navigation Laws upon which we have commented from time to time in these columns. This proposed Codification will be reintroduced into both Houses of Congress for enactment into law during the coming session of that body. It is to be hoped that action will be taken.

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The Editorial Viewpoint

Passing of the Steam Age

CHAIRMAN O'CONNOR of the U. S. Shipping Board recently suggested that using a steamer for ocean transportation when motorships are present is like "trying to use a wheelbarrow to compete with an automobile." This would very clearly appear to crystallize the handicap under which shipowners are operating, who use nothing but steamers in their fleets. Incidentally, it makes all the more difficult to understand the sentiments of an esteemed contemporary of ours, quoted and commented on in a recent article in *The New York Times*, that steam should be given an equal chance with the Diesel in new Shipping Board conversions. And yet perhaps it serves to draw a very sharp contrast between the specialized aims of MOTORSHIP and the more general outlook of the ordinary shipping press, which in an endeavor to serve both steam and Diesel, regardless of its earnestness, cannot escape that division of interest which couples a mild advocacy of the new with a plea for the retention of the obsolescent.

The article in question indicates a feeling of gratification in the knowledge that builders of Diesel machinery who supplied units for the first batch of Shipping Board conversions are being given an opportunity for securing further work. But with this indication of friendliness to the Diesel industry it embodies a suggestion that certain of the money available for motorship conversion might, in effect, be allocated to the fitting of high pressure steam plants and of plants fitted with pulverized coal firing.

Tide of Progress Irresistible

THE DEMONSTRATED ECONOMY of Diesel transportation today, as a study of Lloyd's Register returns will show, has slowly yet surely established the decline of steamers. To attempt to stop so fundamental an economic change by championing less efficient methods of power generation is as futile as adding extra horses to a wagon to compete with the motor truck.

From its inception MOTORSHIP has insisted on the efficacy of the Diesel engine as a prime mover for ship propulsion because we early realized that this engine was a means of generating power in ships which, while in itself expensive, constituted the cheapest possible method of water transportation of passengers and freight. We realized that the Diesel engine was so revolutionary in nature that it rendered all other forms of ship propulsion obsolescent. It ushered in a new era—motorshipping, and the motorship is as different from the steamer as the steamer was in its turn different from the sailing ship. Steam ushered in one era in marine transportation; the Diesel has ushered in the next era. If and when yet another medium, cheaper to operate than the Diesel be produced, then the Diesel in its turn will have to yield.

The Diesel's Superlative Economy

OUR CONTEMPORARY concedes that the Diesel has certain advantages and doubts that it will ever be possible to devise any form of steam plant—capable of competing on a pound of fuel per hp. hour basis with the Diesel, which is a truism of no mean importance to the economy hunting shipowner. But, it says, considering the "possibilities of a combination of low grade, low priced fuel with a modern high grade steam plant, together with the lower price of this installation" for anything except perhaps extreme long voyage trades, steam will have to be reckoned with for many years to come. This is a little difficult to reconcile with the increasing number of Diesel towboats, with developments on the Australian Coast, where even coal is transported in motorships, with fast motor passenger ships in the North Sea and in the Baltic.

The building of large Diesels in the United States today depends in no small measure upon the conversion work of the Shipping Board. A glance at the table of converted ships in our November issue shows generous help has been in this direction. MOTORSHIP has fostered and helped along the placing of such orders by every means in its power from the inception of the idea. Ours has been throughout a completely one-purpose, one-idea point of view. We have consistently fought for the advancement of Diesels. Today the total tonnage of motorships under construction throughout the world exceeds the total tonnage of steam by a gratifying figure. The world's important shipowners today are ordering motorships even for their largest vessels. Such men feel and have stated that the era of steam is definitely passing. The slow but sure advance of the motor engine has had the effect of stimulating the steam engine to further economies, but even so improving the steam engine is like making improvements in the horse and carriage in order to make it compete successfully with the automobile. It is even conceivable that the horse and carriage might be cheaper to operate—but, who today would use it? The hand of progress cannot be stayed. Steam, like sail, is obsolete.

Japan Operating Coastwise Motorships

JAPAN NOW finds it profitable to operate fast coastwise passenger and cargo motorships of size and speed comparable with the ships operating on the American Eastern Seaboard. We indicated in our last issue that the motorship is creeping into the coastwise trade, both passenger and freight, in Australia. In the North Sea and in the Baltic examples are also to be found of coastwise type passenger ships both passenger and freight. It seems more than strange that American coastwise shipowners who between them operate about 4,000,000 tons of shipping protected from international competition by coastwise laws, should thus far have been apparently blind to the possibilities of the Diesel engine for this type of work.

Japan's newest coastwise ships are intended for service between Kobe and Tientsin via Osaka and Shimonoseki, a voyage which includes navigating the crowded Inland Sea of Japan and running up the shallow Peiho River from Taku Bar, the port of call for large ocean-going ships. Dimensions of these new ships—298 ft. by 45 ft. 6 in by 17 ft. draft—compare with those of the new steam driven Red D liner CARACAS, which in accordance with prevalent American Coastwise conservatism is steam driven. Ss. CARACAS is 323 ft. by 51 ft. by 18 ft. draft, but the motorship has a 15 knot service speed with 3000 Sulzer hp. while the steamer has but 13 knots sea speed, on 16 ft. draft, with 3500 s.hp. The cabin accommodation of the steamer is much greater than that of the motorship, and the comparison between the two is, of course, by no means rigid. It should serve, however, to illustrate very clearly to those people who would rule out the motorship from American coastwise service on account of the impossibility of getting the Diesel engine within the required weight and space requirements, the fallacy of this idea. On the German Baltic coast, there is a fast coastwise ship with accommodation for 1403 passengers, which is capable of making 20 knots. The question of extra first cost is a bogey which doesn't stand up to the searchlight of criticism because that first cost is recovered in a very short space of time and during the time it is being recovered the operator enjoys all the advantages of the superior transportation the motorship alone can give. Engine crews must be hand-picked, however. The best engine on earth—and its reputation—is liable to be irreparably damaged by a "butcher's" crew.

An Important Motorship Link

AS A MATTER OF FACT the Kobe-Tientsin motorship link of the Osaka Shosen Kaisha connects Kobe, Japan's foremost commercial port, with Tientsin, the gateway to the Capital of China, and affords the travelling public a unique opportunity of studying these two great nations in the Far East. Tientsin, opened to foreign trade in 1860 by the Peking Treaty, is the most thriving city in North China. Situated only 80 miles away from Peking, the city spreads along both banks of the River Pieho, the distance between the city and the mouth of the river being about 40 nautical miles. Thus, Tientsin constitutes one of the most important transit ports of the Far East, and as such it has vital connections with the principal Japanese ports.

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Until quite recently, however, the River Peiho was too shallow to admit ships of ordinary type to navigate up to Tientsin, so they had to moor at Taku, whence passengers were taken by launch to Tang-ku, thence by real to Tientsin,—a tedious and troublesome journey.

Thanks, however, to the efficient work of dredging undertaken by the Haiho Conservancy Board, steamers and motorships of a much deeper draught are now able to proceed up the river. This prompted the Osaka Shosen Kaisha to introduce every possible improvement in their Kobe-Tientsin Service, and three new motorships have just been put on the berth. Starting from Kobe, they reach Taku, whence they go up the river, and straightway moor at Tzu-chu-lin, in the French Concession, Tientsin,—to the great convenience of the passengers.

The new ships CHOJO MARU, CHOAN MARU and CHOKO MARU are each of 2600 tons, and measure 298 by 45½ feet, with a draught of 17 feet. They are propelled by Sulzer Diesels of 3000 i.hp., and have a service speed of 15 knots.

The ships are each equipped with 9 cabins, each containing 2 single berths, and 4 four-berth cabins, besides 87 3rd class berths. The owners state that "germ-spreading dust and soot are eliminated by the use of Diesel engines,—every nook and corner being perfectly clean and neat."

Double-Acting Airless Injection Diesel

ONE OF THE most interesting contributions to the art of Diesel engine building is the double-acting 2-cycle airless injection engine recently completed by Richardsons Westgarth & Co., Hartlepool, England. This engine, which has been designed by W. S. Burn, M.Sc., is one of the most compact engines which we have seen and the designer has had in mind the elimination of as many parts as possible together with a combination of low weight and therefore low cost. The 24 days non-stop trial under normal working conditions has been recently completed. The average fuel consumption worked out at 0.4 lb. per brake hp. hour. This engine is to be marketed on a commercial basis in the near future, and its development will be worth watching.

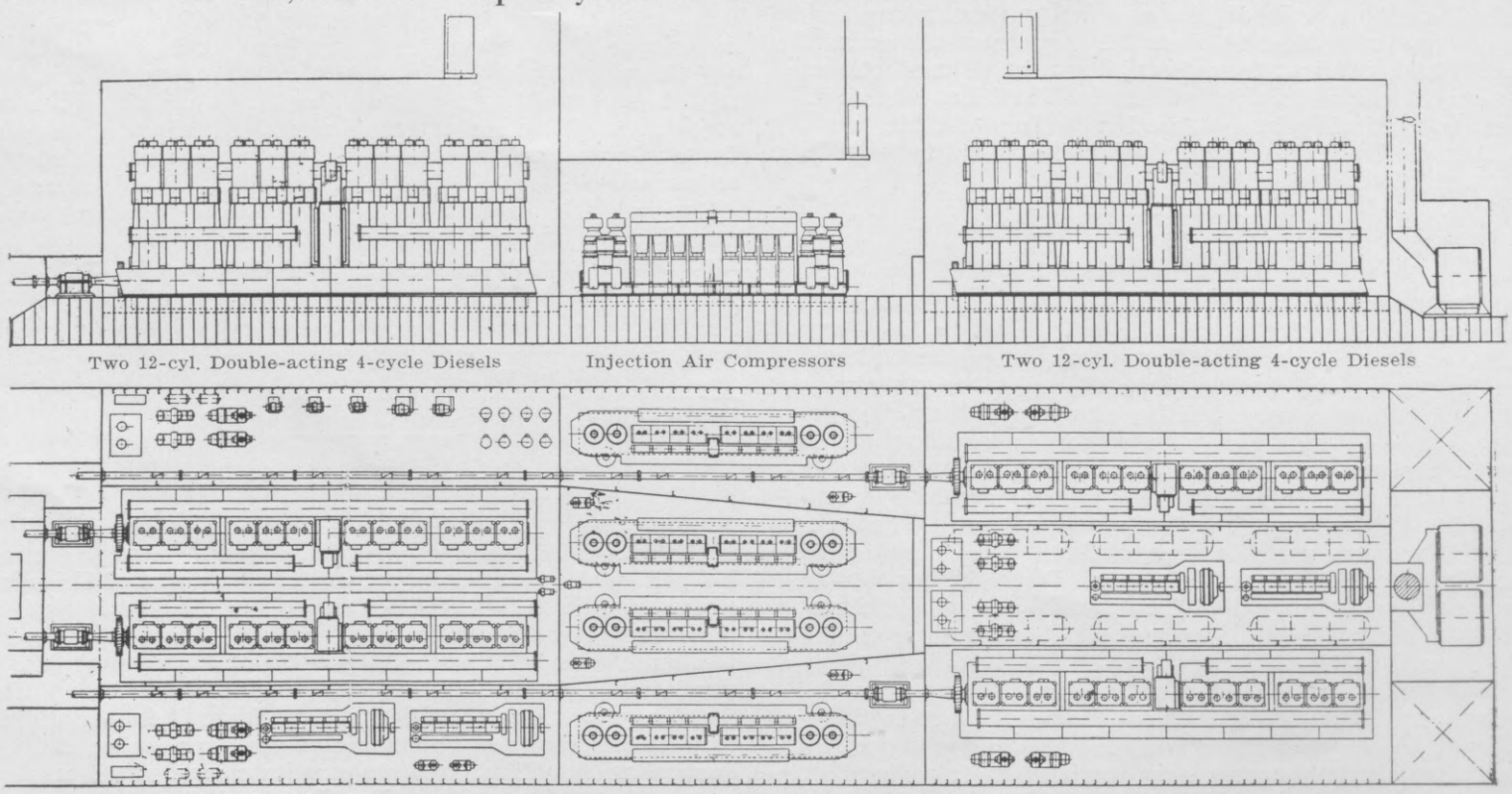
Towboats and Smoke Nuisance

NEW YORK TOWBOAT owners who do not appreciate the advantages accruing and economies attendant on fitting Diesel engines in their vessels may conceivably find themselves forced to adopt this method of propulsion merely by reason of legislation. Dr. Harris, Health Commissioner for New York City recently called attention to the use by towboats in New York Harbor of soft coal. In effect this use of soft coal, which of course is not allowed on shore, constitutes a serious smoke nuisance, and it is conceivable that owners must look forward to the day when the law will make it necessary for them to use Diesel engines. Coal is everywhere a dirty and uneconomical form of producing energy, its only advantage being that of initial cheapness. Initially the oil engine is expensive and so is the fuel which it uses, but the economies attendant upon the use are so great that the initial cost is very easily overcome. There are numbers of good domestic Diesels on the market ready to meet the towboat owners requirements.

Super Power for Super Ships

THE NEW YORK HERALD TRIBUNE recently contained an amusing illusion to the effect that a party of the White Star Line London officials had recently entered this country one day on a French Liner and departed two days later on a German liner, with the object of making outward and homeward a thorough inspection of the vessels in question. This, our contemporary would have us think, is indicative of the fact that new construction may be shortly expected from this company. It is, of course, an open secret that the White Star Line has been considering the construction of a mammoth passenger liner for some time and that also the Cunard Line will shortly have to follow suit. Their recent financial activity would seem to support this. The great question exercising minds of everyone concerned is naturally—What form of propulsion will be adopted? If the ships are of mammoth type and there is every reason to suppose that they will be, the question arises—Will Diesel engines be able to power them? In this connection it is interesting to note that a well-known firm of Diesel engine builders of international reputation sends us a catalog in which they publish plans for a quadruple screw Diesel power plant of 100,000 hp., which is quite ample to take care of the needs of any mammoth passenger liner. We ourselves are inclined to the theory that Diesel-electric drive will solve the problem of super-power for super-ships so that it is interesting to see this big double-acting engine idea put forward, especially in view of the fact that the auxiliary machinery, which we have always considered as rather a bugbear in these largest installations, seems to have been cut down to occupy reasonable space. At any rate, it goes to show that the eyes of the Diesel engine builder are very definitely not closed beyond the 30,000 or 40,000 hp. mark. The developments in the next few months will certainly be worth watching.

A 100,000 Diesel Hp. Layout for the New Mammoth White Star Liner ?



In view of the persistent rumors of contracts for a new White Star mammoth, it is significant that Burmeister & Wain should publish the above layout for double-acting 4-cycle Diesels of 100,000 hp.—a greater power than that necessary to power the Leviathan. Each engine is a 12-cylinder unit with 41.5 in. cylinder diameter and 76.5 in. stroke operating at 100 r.p.m. Each engine must develop 25,000 hp.—the total power of the Augustus—and each cylinder 2100 hp., practically double the power and size of any existing cylinder. The layout is published in a paper read by Paul Hansen of Burmeister & Wain, Ltd., before the Interscandinavian Union of Engineers Copenhagen.

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World Motorshipping—1927

A Review of the Existing Position of the Motorship and an Analysis of Its Distribution by Nationalities, Types and Trade Routes

WORLD motorshipping, at the end of the year 1927, has advanced to a position where over 700,000 gross tons more ships are building equipped with marine internal combustion engines than with marine steam engines, a total of 1,589,000 tons for motorships comparing with 1,485,000 tons for all other types of vessels combined. This is significant when coupled with the fact that Lloyd's Register book, the standard source of information on such matters, now shows 2552 motorships with a total gross tonnage of 4,270,824 while the 1914 edition of the same book showed only 297 motorships with a total gross tonnage of 234,287.

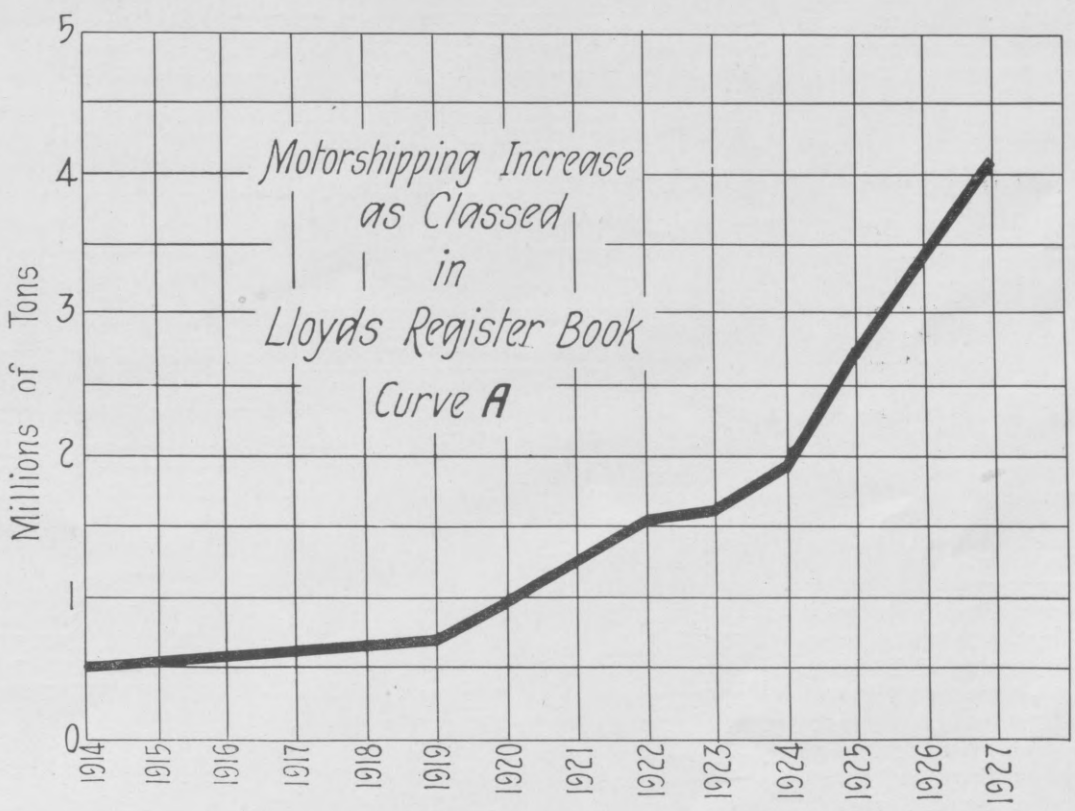
Moreover the 1914 list of motorships in MOTORSHIP MANUAL shows for its biggest power vessels with the 2600 hp. of the E. Asiatic Co.'s ANNAM propelled by two 8-cylinder B. & W. single acting 4-cycle Diesels of 23.-23 in. bore and 31.63 in. stroke, while the 1927 list includes ships like the big passenger liner AUGUSTUS propelled by four double-acting 2-cycle M.A.N. Diesels each of 7000 s.hp. and having cylinders 27.5 in. bore by 47.2 in. stroke. This growth of some 4,036,537 gross tons in some 13 years is well shown in the table of motorship increase and in Curve A. Note that this curve shows its steepest slope, or rate of increase, between the years 1924 and 1927, in other words in the last three years of the 13-year period at the beginning of which motorships began to make their presence felt in Lloyd's Register Book. This curve in itself, however, is not sufficient to give a true indication of the state of affairs and must be further interpreted in connection with Curve B and with the Marine Propulsion table. What does this table show?

Speaking generally, we may state that there is a decline in the tonnage classed with Lloyd's having both steam reciprocating engines and steam turbines and an increase in tonnage classed with internal combustion engines. With this general steam decline and motor increase, and the fluctuations thereof which the curves indicate, there has been a concurrent falling off of the total tonnage classed, due partly to the removal gradually of much left-over war-time shipping included in the 1918-19 list and partly to the fact that there has been a falling off in world ship construction. Thus the 1926-27 book shows a total of only 393,225 gross tons classed, as against 1,324,789 tons for the 1925-26 book. Remember, of course, that in dealing with these figures we are discussing only the tonnage classed with Lloyd's Register. This covers therefore only a proportion of total world tonnage, but it is such a representative coverage, that Lloyd's figures may be taken very logically as a ship construction barometer of no mean dependability.

The latest figures show that motorshipping exceeds turbine shipping by 224,668 tons and is less than "Scotch and reciprocating" by only 11,955 tons—one more SATURNIA classed in the book would tip the scales in favor of the motorship. And all this is taking place on a decreasing shipbuilding output with a falling off of 357,727 tons in one year.

Coincident with all this we may discover that there has been in the 9 years from 1918 to the present year a big decline in coal burning tonnage with a corresponding increase, of course, in oil using tonnage. Coal using tonnage amounted to 66.2 per cent of the total in 1918. Today it has dropped to barely 31 per cent—a serious state of affairs for the coal industry which can be rendered none the more comforting by the knowledge that it is now more economical to use motorships than it is to use steamers for the transportation of coal on the eastern Australian seaboard. The motorshipping man, we may concede, has every reason to be pleased with himself. But it is not sufficient to leave it at that. We have quoted our motorshipping tonnage and the number of ships it contains — nearly two and one half thousand. How is this fleet distributed on the World's waterways and seaways? An analysis will give us an even better grasp of the present world motorshipping position.

It will show, for example, in considering the seven principal motorshipping nations of the world and the totality of these ships in actual sea transportation service, that in round numbers about one fifth of the total number of motorships in the register book is actually engaged in long and short haul ocean services. An analysis, on the basis of national distribution of this group, reveals some instructive anomalies. Great Britain, for example, which is constitutionally not a motorshipping nation by virtue of her immense coal deposits, owns and operates no less than 49 per cent of the total as Diagram A shows. Note, however, that



Motorship Increase 1914-1927

Curve A

Register Book Date July	Motorships Registered Gross Tons	No. of Ships
1914	234,287	297
*	*	*
1919	752,606	912
1920	955,810	1,178
1921	1,248,800	1,473
1922	1,542,160	1,620
1923	1,666,385	1,795
1924	1,975,798	1,950
1925	2,714,073	2,145
1926	3,493,284	2,343
1927	4,270,824	2,552

Coal Burning Tonnage Decline 1918-27

Curve C

Year	Gross Tons	Coal Oil Per Cent.
1918-19	2,491,213	66.2
1919-20	2,111,289	50.4
1920-21	1,260,465	39.0
1921-22	895,032	35.5
1922-23	662,565	41.1
1923-24	468,153	53.5
1924-25	671,405	51.2
1925-26	418,503	31.6
1926-27	297,948	30.8

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of this 49 per cent, nearly 20 per cent is owned by one shipowner—Lord Kylsant, owner of the Royal Mail Steam Packet Co., and controller of nearly 3 million tons of shipping which he is rapidly Dieselizing in all branches. This 20 per cent of British motorshipping amounts to 9.2 per cent of world motorshipping and is only slightly less than the 9.6 per cent of Italian motorshipping. Italy is as active now as she was when a previous review of this nature appeared in these columns†

Her contributions to the motorship building art during the past 12 months have been noteworthy, culminating in the two largest motor passenger liners in the world —the 27,000 hp. AUGUSTUS and the 20,000 hp. SATURNIA. The propulsion of each ship is effected in a different manner although each has double-acting Diesels. Their characteristics, lined up side by side, make interesting contrast, especially as both are now employed in Italy-S. America trading.

Table A—Motorships in Ocean Freight and Passenger Service at Dec., 1927

BASED ON TOTALS OF WORLD'S SEVEN MAIN MOTORSHIP OWNING NATIONS

Great Britain	49.0 per cent
Lord Kylsant	*9.2 per cent
Germany	16.0 per cent
Italy	9.6 per cent
Holland	7.6 per cent
U. S. A.	†7.6 per cent
Scandinavia	34.0 per cent
Japan	3.5 per cent

*19 Per cent of British Motorshipping.
† Includes only ships on long haul routes. The total including bay and sound ships is nearly 25 per cent.

One of the most outstanding features in the whole of the national distribution table is the favorable position occupied by U. S. tonnage. Thanks largely to the efforts of the Shipping Board, America's percentage, which includes long haul ocean ships as well as large coastwise tankers and intercoastal freighters of ocean-going type, is as great as that of Holland. The Dutch it should be remembered, are now enthusiastically embracing the Diesel cause. If, however, we include among American motorships types of 300 tons and over, a consideration of small coastwise and bay tankers, Great Lakes freighters, and some large ferryboats, we find that America owns and operates some 25 per cent of the adjusted world total. This would appear to indicate a very flourishing state of affairs for the American Diesel industry.

The case of Scandinavia is interesting and more especially so in the light of Table C. which divides tonnage into tramp and liner categories. The Scandinavian nations are the greatest carriers of the world's goods other than their own. Their own needs relatively are small and easily taken care of. The 34 per cent of world motorshipping that Scandinavia owns, a percentage second only to that of Great Britain, is employed in bringing Europe's wheat from the River Plate, in taking U. S. Pacific Coast produce to the Far East, and in bringing Brazilian coffee to San Francisco. A total of about 71 per cent of all Scandinavian motorshipping is engaged in tramp

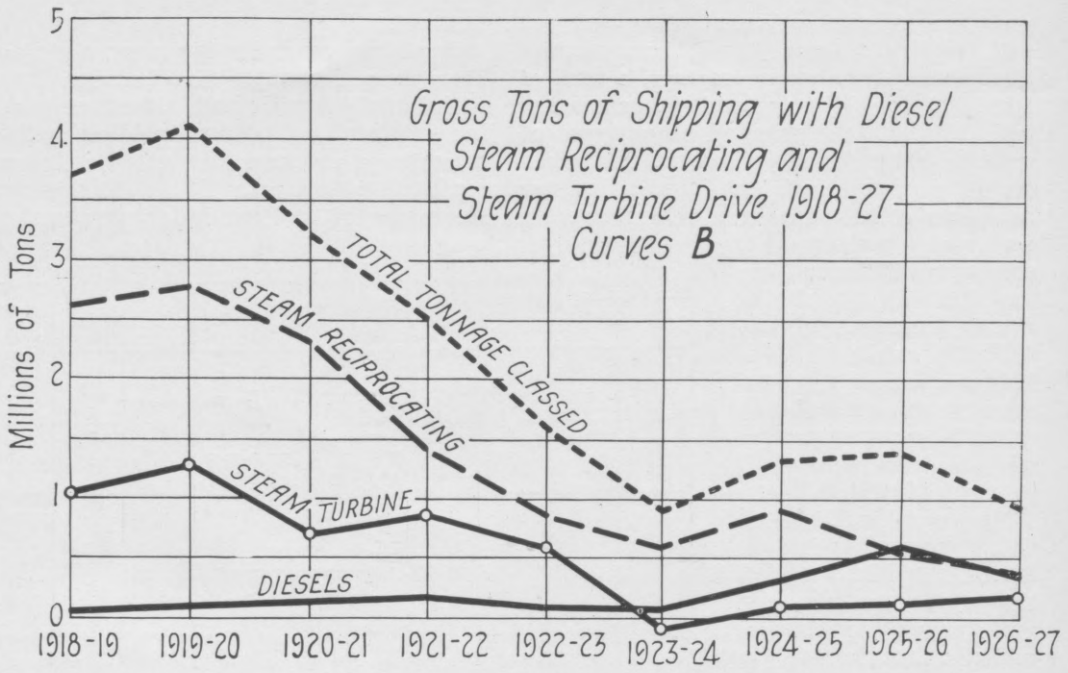
†See "World's Motorship Development in 1925," by A. C. Hardy, B. Sc., MOTORSHIP, January, 1926, P. 34.

Comparison Between Italian Motorliners Saturnia and Augustus

NAME	SERVICE	REG. DIMS. FT. L.	B.	D.	TONNAGE	NO. OF PASS.
Augustus	Genoa-S. America	664.5	82.6	42.5	32,000 G.	2,178
Saturnia	Trieste-S. America	599.0	79.5	45.5	23,900 G.	2,197

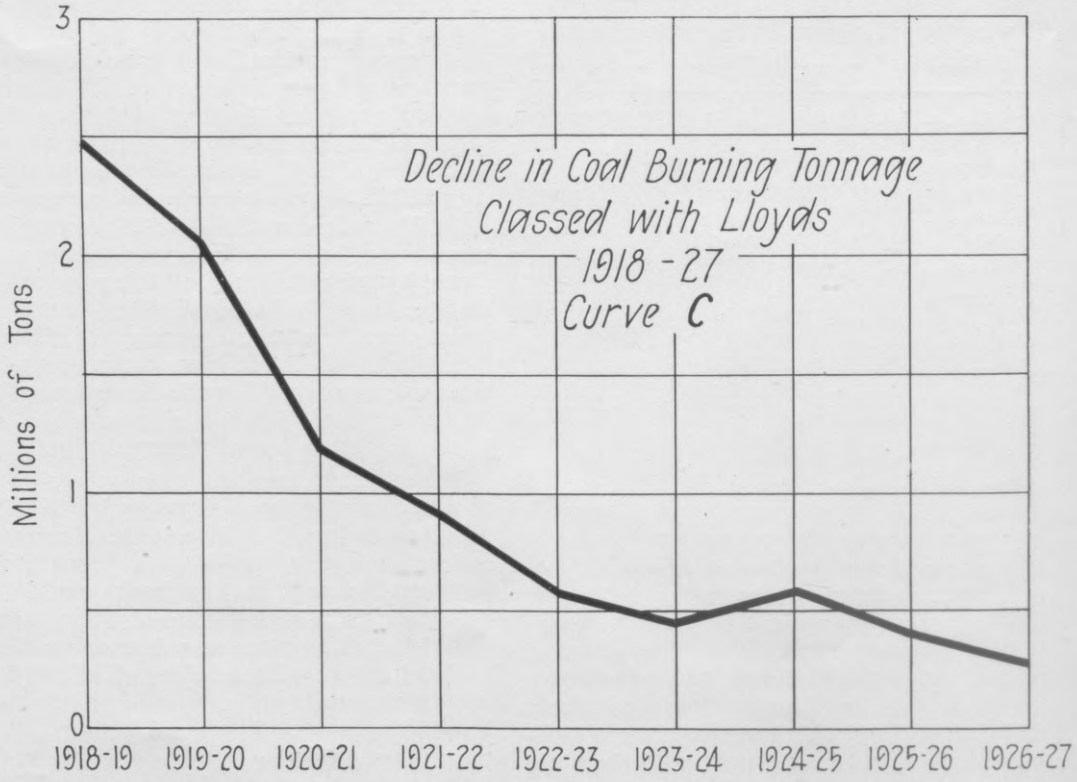
NAME	TOTAL POWER	SPEED	NO. OF ENGS.	INS. BORE	INS. STROKE	R.P.M.	TYPE	NO. OF CYLS.
Augustus	28,000 S.*	20	4	27.5	47.2	125	2-cyc. D. A.	6
Saturnia	20,000 B.	19	2	33.1	59.1	125	4-cyc. D. A.	8

*Extreme rating—probably normal rating 25,000 b. h. p. at 120 r.p.m.



Marine Propulsion 1918-27
Curve B

YEAR	TYPE OF ENGINES—STEAM RECIPROCATING Gross Tons	STEAM TURBINES Gross Tons	MOTORS Gross Tons	TOTAL TONNAGE CLASSED Gross Tons
1918—1919	2,633,570	1,051,302	75,934	3,760,806
1919—1920	2,821,031	1,286,046	79,805	4,186,882
1920—1921	2,373,067	754,513	101,608	3,229,188
1921—1922	1,420,924	870,037	226,552	2,517,513
1922—1923	842,358	603,037	165,229	1,610,624
1923—1924	610,851	99,464	164,336	874,651
1924—1925	894,807	114,009	302,461	1,311,277
1925—1926	575,984	146,354	602,451	1,324,789
1926—1927	405,280	168,557	393,225	967,062



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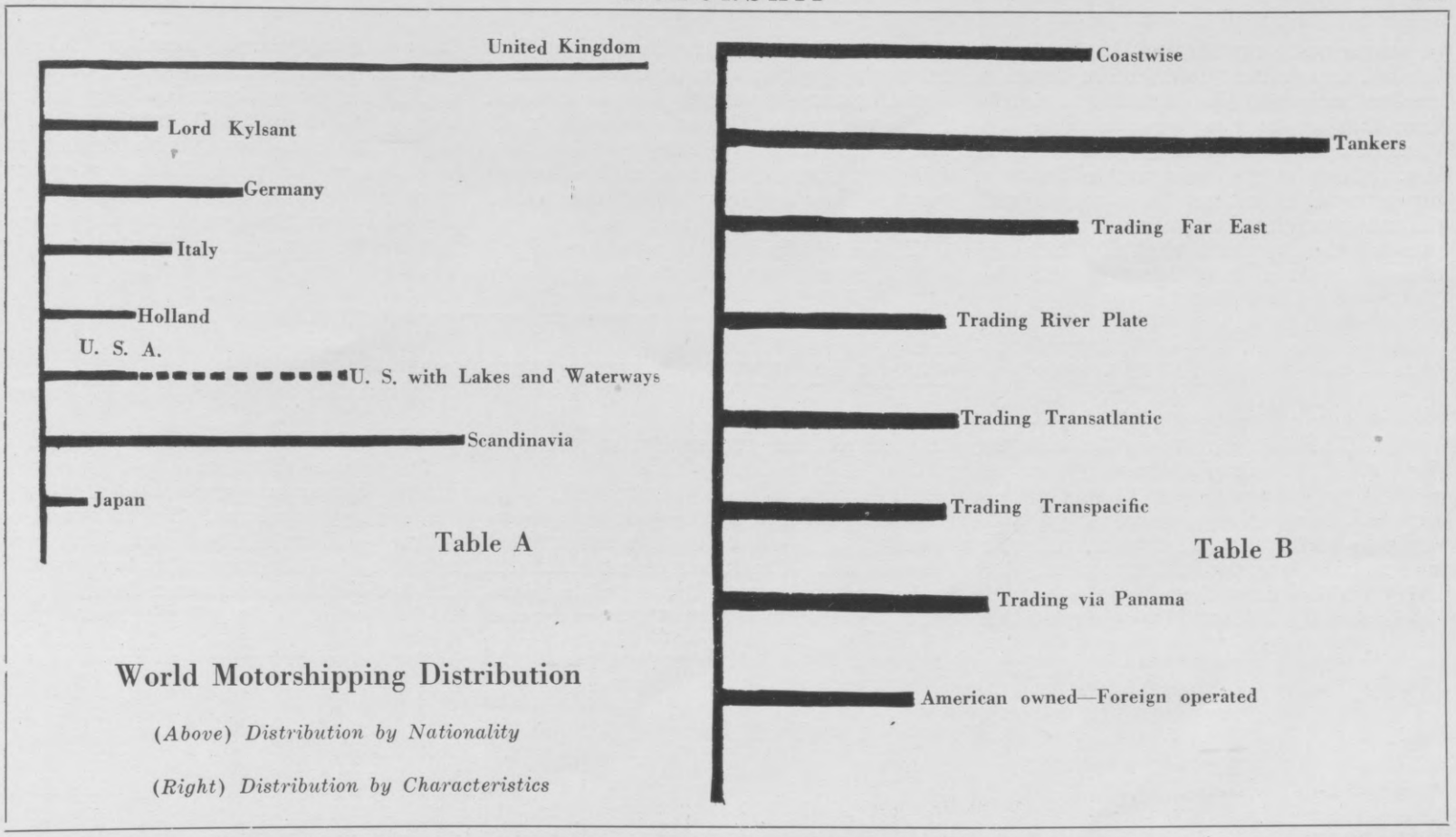

World Motorshipping Distribution

(*Above*) *Distribution by Nationality*

(*Right*) *Distribution by Characteristics*

work, and when we consider that the Scandinavian nations are the second largest motorshipping group in the world, we begin to wonder whether the statement, so freely expressed of recent years, that with the advent of the motorship the tramp is tending to disappear, is correct. As a matter of fact the statement is correct in the general but not in the particular, the difference being that whereas in the old days the steamer was a literal tramp, picking up cargoes here and there, the motor tramp—particularly the Scandinavian one—operates on long term charters. Distinguish here, however, between ships like the SVEALAND and AMERIKALAND, Swedish-owned, German-built bulk motorfreighters operated under a 20-year charter to the Bethlehem Steel Corp. to carry ore between Cruz Grande and Sparrows Point, Md., and a motorship like the FALSTERBO, at present operating a short term charter in trans-Pacific trade, or the ore carrying ship ERIK FRISELL, commissioned in June, 1926. Leaving Gothenburg on July 15 in ballast she proceeded to San Pedro, California, via Panama canal, averaging 12 knots for the trip with the exception of the run through the canal. Fuel was taken on at San Pedro, and then the vessel came on to Coos Bay and the Columbia River to load lumber for Shanghai. With this heavy lumber cargo including the high deck load of lumber shown in the picture she averaged 11½ knots across the Pacific. From Shanghai she came in ballast to the Fraser River and Vancouver, B. C., to load a lumber cargo for Yokohama, being in British Columbia waters during the early part of November.

Then, again, there are ships like the small fruit carrier GUNDERSEN, running under long term charter to the United Fruit Co., and the Pacific Coast-S. America motorships of the Westfal Larsen Co., operated by the General Steamship Corp. of San Francisco. A very big percentage of Scandinavian motorshipping constructed during the last few years has been built expressly for use by American operators, and the table shows that of existing motorship tonnage now in service a total of 10.3 percent is actually American controlled but foreign-operated. Which, incidentally, should cause advocates of the elimination of the U. S. Shipping Board furiously to think.

A proportion of this 10.3 per cent is intimately concerned with tanker tonnage, most of the big oil companies in U. S. operating ships to various countries under the flag of the country in question. In considering Table B, we find that a consideration of motorshipping by routes and characteristics shows no less than 32.6 per cent of existing operating Diesel tonnage is tanker tonnage, and referring again to Table C we find that the motor tanker fleet contains the highest percentage of liners—60 per cent. This is really what might be expected because after all a tanker's role is essentially a regular service or liner role. Perhaps the more remarkable fact is that as high a tanker percentage as 40 per cent should be of tramp category. Here again we notice the hand of the Scandinavian tramp group which contains short term charter vessels and even long term charter tankers like the VARANGER and NORDANGER now operated by the Standard Shipping Company, New York. A further study of Table C shows that at the time of writing slightly more tramp tonnage is operating transpacific than transatlantic. The difference is not great and is naturally of a fluctuating nature. If anything, one would expect transatlantic tramp figures generally to be higher because of the River Plate and St. Lawrence grain trades.

In considering motorshipping by routes and characteristics, it is surprising to find such a high percentage as 19.6 engaged in coastwise and short sea work. This includes ships of over 300 tons on service along coastlines and on short sea runs, such as in the North Sea and the Baltic. The figure would appear to constitute a direct refutation of the theory that the motorship is inapplicable to short voyages. It is a strange paradox that America which possesses the longest coastlines and therefore the greatest number of domestic ship types of any country in the world should possess the smallest number of coastwise passenger and passenger cargo motorships whereas the 3.5 per cent that Japan has of the world total has almost half devoted to coastwise

Table B—Motorshipping by Routes and Characteristics

Route or Feature	Percentage of Existing Operating Tonnage
Coastwise and short sea	19.6 per cent
Tankers	32.6 per cent
Trading to Far East	19.3 per cent
Trading to R. Plate	12.0 per cent
Trading transatlantic	12.5 per cent
Trading transpacific	12.2 per cent
Trading via Panama	14.4 per cent
American owned—foreign operated	10.3 per cent

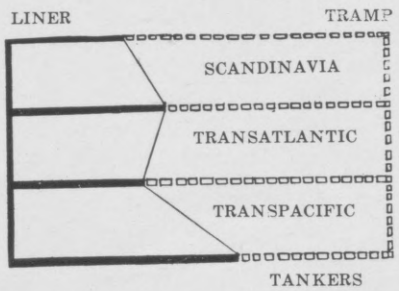

Table C—Motortramp Motorliner Ratio

Route or Nation	Liner Percentage of Total
Scandinavia	29.0 per cent
Transatlantic	41 per cent
Transpacific	35 per cent
Tankers	60 per cent

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passenger and cargo ships of the 14-15 knot less. There exists, however, in Japan a smaller motorshipping merchant marine than that of America, but remember also that the actual length of coastline is much less. There exists, however, in Japan a big potential Diesel market in the ships of the many services maintained between Japan and the mainland, most of which are of two to three days' duration. So also there is a big market for the America Diesel engine just as soon as coastwise shipowners become thoroughly Diesel conscious.

The present position of motorshipping is one which should give every cause for satisfaction. On all long haul routes the motorship is a definitely established factor. It is breaking rapidly into the passenger liner field and the trend of opinion on coastwise services may perhaps be judged by the gratifyingly large percentage of Diesel powered vessels therein. Much educative and illustrative work needs still to be done and he would be a bold man who would suggest the Diesel as a perfect prime mover at the present time. Much development work needs to be done. It stands alone, however, when it comes to economy of operation and that, in the last analysis, is what interests the shipowner.

Fishing Vessels Prove Economy of Diesels

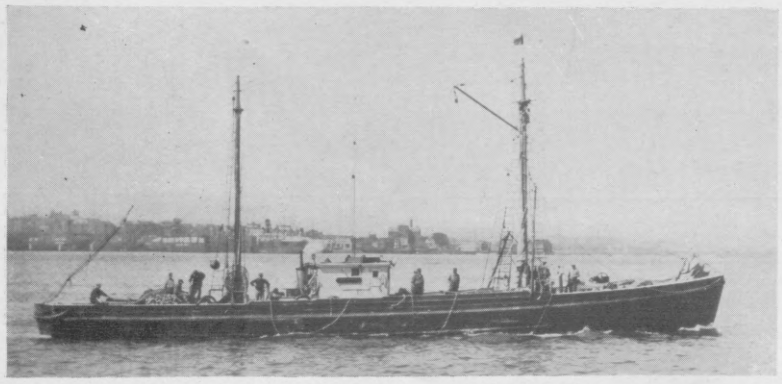
PERHAPS no marine service calls for such reliability of power plant and operating economy as that of fishing vessels. These ships are "on the go" continually and must take advantage of every minute of the various fishing seasons. Any delay which causes them to miss a day's catch is costly indeed. Not only must they take advantage of every fishing day, but operating costs must be kept at the lowest possible point if they are to show a profit. It is a noteworthy fact that more and more fishing vessels are turning to Diesel power because of their utter dependability and their marked operating economy.

The schooner ALDEN, owned by John R. Morash of Gloucester, Mass., operates throughout the summer as a mackerel seiner, and beginning about October 15, she is used as a beam trawler. This ship works 12 months of the year and consequently the power plant is in almost continuous use. The ALDEN is powered with a 4-cylinder Bessemer Diesel and has demonstrated conclusively that her power plant not only can be relied upon for day-in-day-out service but that the fuel and operating costs are exceptionally low.

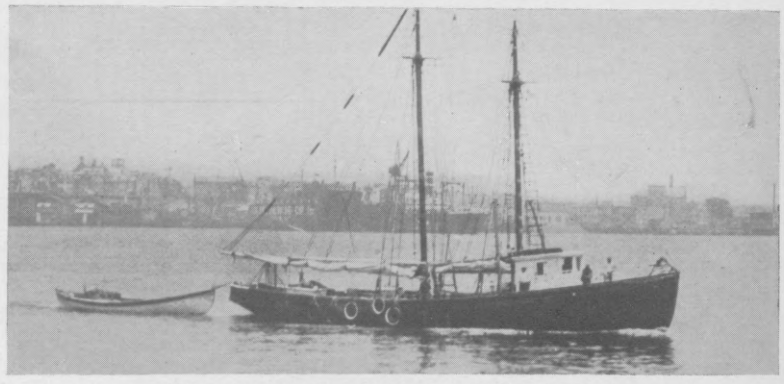
The schooner COLLEEN is one of the O'Hara Bros. fleet, all of which are Bessemer powered. COLLEEN is a beam trawler and is in service 12 months a year. She is 86 ft. long, 19 ft. beam, 10 ft. 6 in. draft and is powered with a 230 hp. 6-cylinder Bessemer Diesel with a one-way clutch.

The schooner INCA is a mackerel seiner during the summer months and a gill netter during the winter. She is owned by Murray & Tarr of Gloucester, Mass., captained by Lee Murray and powered with a 110 hp. 4-cylinder Bessemer Diesel. INCA is the fastest in the gill netting fleet out of Gloucester.

The schooner ZILPHA is owned by Capt. William Tobey and Arnold & Windsor Co., of Boston. In the summer she goes seining and sword-fishing and in the winter months is used for flounder dragging. The ZILPHA is 70 ft. long and draws about 10 ft. or 11 ft. and is powered with a 3-cylinder 60 hp. Bessemer Diesel.



Converted submarine chaser John R. Morash

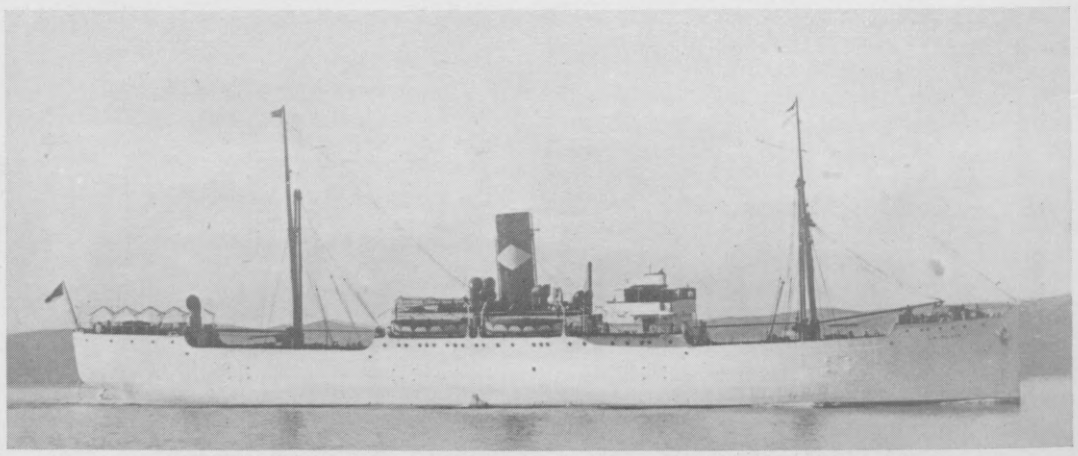


Schooner St. Rosalie has 110 Bessemer hp.

Re-engined Diesel-electric La Playa Resumes Service

UNITED FRUIT CO.'S Diesel-electric ship LA PLAYA which has recently had her main generator engines replaced by Fiat Diesel at the Stablimento Tecnico Triestino, Trieste, Italy, arrived in New York late in November from Cristobal. This was her first visit to New York since the alternation work has been carried out. Some details of the new engines with which the ship is fitted and of the test bed performance were given in MOTORSHIP for December and it is proposed to describe the present installation, as it exists on the ship, in a subsequent issue.

The original Camellaird-Fullagar opposed piston Diesels have been removed and three 950 b.hp. Fiat crosshead Diesels, of the type made in America by the Nordberg Mfg. Co., Milwaukee, Wis., have been substituted. Each engine has four main cylinders 19.69 in. bore and stroke interposed between a 3-stage injection air compressor at the forward end and tandem scavenge pumps at the aft end of the engine.



Re-engined Diesel-electric ship La Playa made 14.36 knots on trials

MS. LA PLAYA made 14.36 knots on standardization trials in the Adriatic, this being a mean of two runs. Her mean draft was then 15 ft. 5½ in. We are informed that the maximum speed with the old power plant was 13.35 knots. On a 5 day trial the ship ran between two fixed points 45.2 sea miles apart in 3 hrs. 10 min., a speed corresponding to 14.26 knots. The new performance of the vessel seems to be in every way satisfactory and creditable, and should improve even further in operation.

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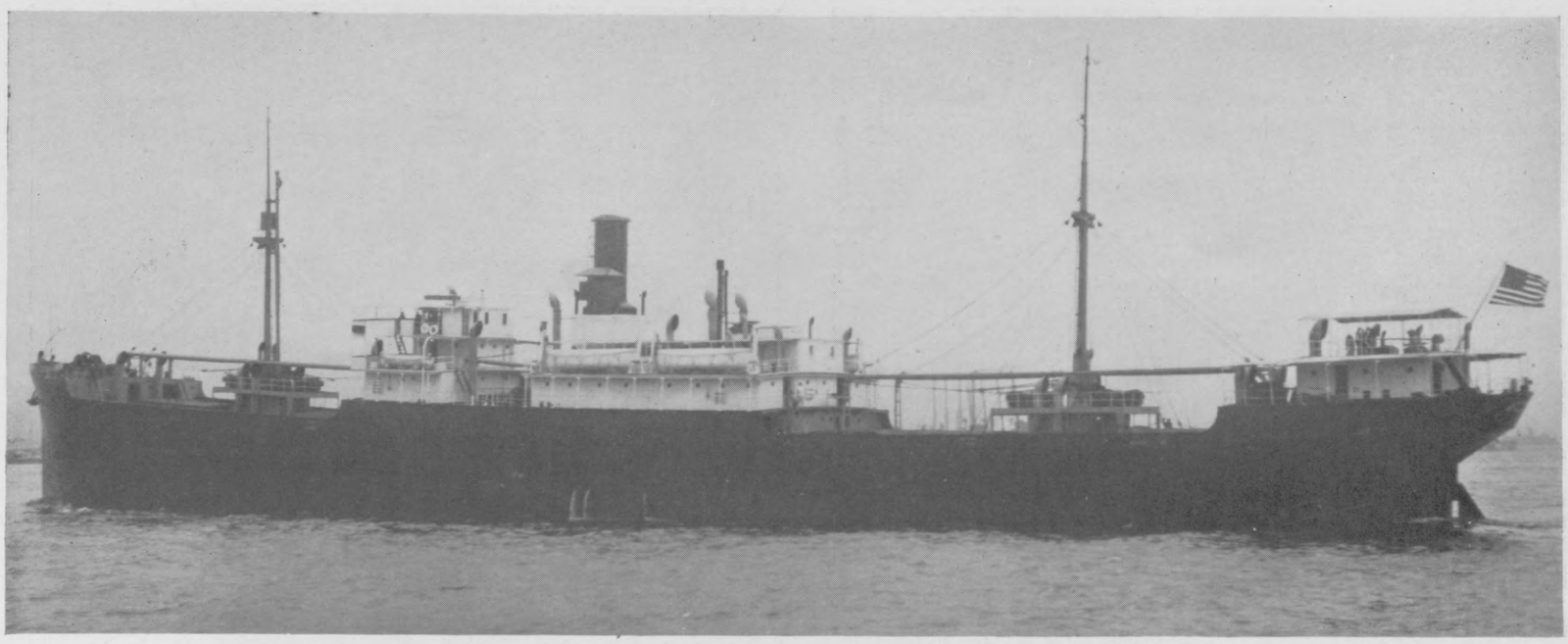


Converted Shipping Board Ms. Seminole

Latest Ship Added to Conversion Programme Has a Double-Acting 2-Cycle Diesel Developing 3,680 B.hp. at 115 R.P.M.

MS. SEMINOLE is the most recently converted of the first batch of Shipping Board Conversions and the necessary work on her has been carried out by the Todd Shipyards Corp., at their Hoboken, N. J. plant. She and the Busch-Sulzer engined YOMACHICHI differ from the rest of the converted fleet in that no passenger accommodation has been fitted. This was decided upon by the Board as an advisable step with a view to reducing the conversion cost. Even so, the result, as the inboard profile reproduced below well shows, is a thoroughly up-to-date motor cargo carrier which should have no difficulty in maintaining a loaded service speed slightly in excess of 12 knots. And in this connection it is interesting to recall that during her recent trials, before she was handed over to the Roosevelt Lines her present operators, Ms. SEMINOLE made just 14 knots, light ship.

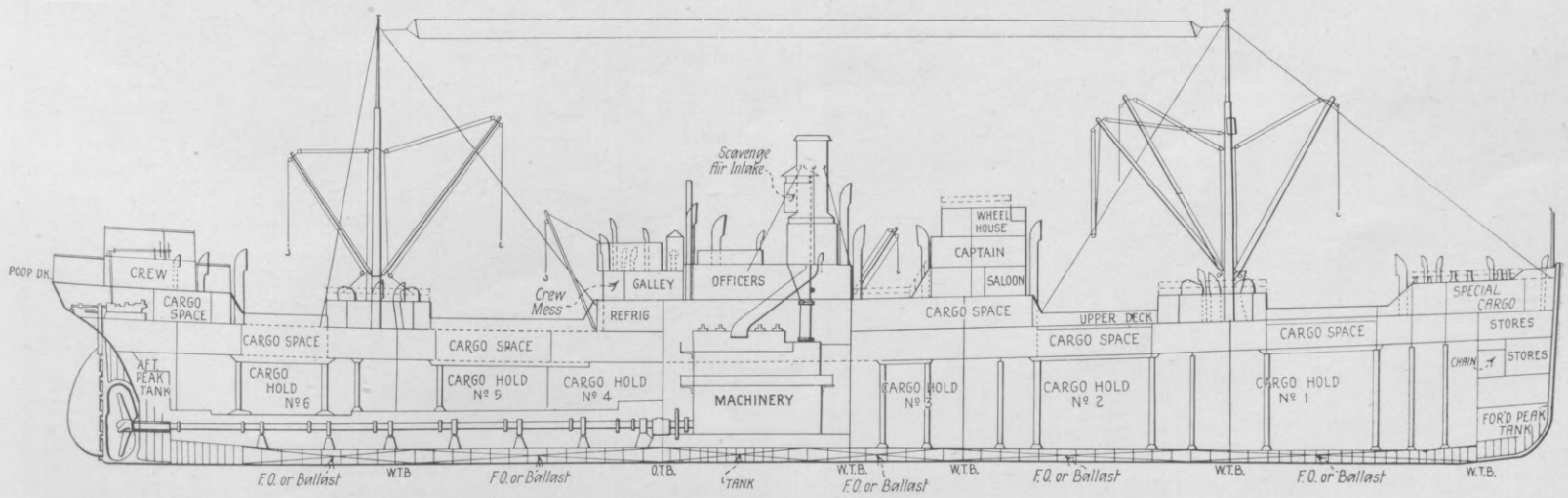
This excellent speed is unquestionably in no small measure due to the fact that the vessel is powered by a 3680 b.hp. double-acting 2-cycle Diesel of Hamilton M.A.N. type. This engine has 4 cylinders and in addition to the four double-acting power cylinders there is a 3-stage compressor for starting and injection air, also a twin cylinder double-acting scavenging pump. The entire engine weighs only 850,000 lb. and measures 40 ft. 0 in. overall. It is 15 ft. 0 in. wide and rises to a height of 28 ft. 0 in. above the shaft center.

Characteristics of Ms. Seminole

Gross tonnage	5868 tons
Net tonnage	3673 tons
Length overall	416 ft. 0 in.
Length b.p.	402 ft. 0 in.
Beam, molded	54 ft. 0 in.
Depth, mld. to upper dk	33 ft. 9 in.
Displacement, load	13,010 tons
Draft at above	26 ft. 10¾ in.
Power, main engine	3680 b.hp.
Service speed, about	12.5 knots
Total deadweight capacity	9235 tons
Fuel oil, double bottom	760 tons
Cargo space capac. (bale)	447,800 cu. ft.
Cargo space capac. (grain)	386,449 cu. ft.
Deep tanks (liquid)	1051 tons

The engine operates on the air injection principle and has one fuel valve located in the upper cylinder head and four fuel valves located in the lower cylinder head. In addition, there are starting valves both on top and bottom, and relief valves.

The fuel valve is in the center of the head and is the only valve in the head proper. The starting valve and the relief valve are fitted horizontally in the upper part of the cylinder, and recesses for them are formed in the heat shield. Through the lower cover, of course, passes the piston rod, for which a water cooled stuffing box is provided in the outer cover. This stuffing box prevents a central fuel valve being used, and in place of it are found four small horizontal fuel valves, slightly offset from the cylinder diameter in order to give a good distribution of fuel without the sprays impinging upon the piston rod. A starting valve and a relief valve are fitted in the lower cylinder end in the same manner as in the upper cylinder end.



Ms. Seminole, the newest addition to the rapidly growing fleet of converted Shipping Board motorships, is powered by a 4-cylinder, double-acting, 2-cycle, Hamilton M. A. N. Diesel, developing 3680 b.hp. at 115 r.p.m.

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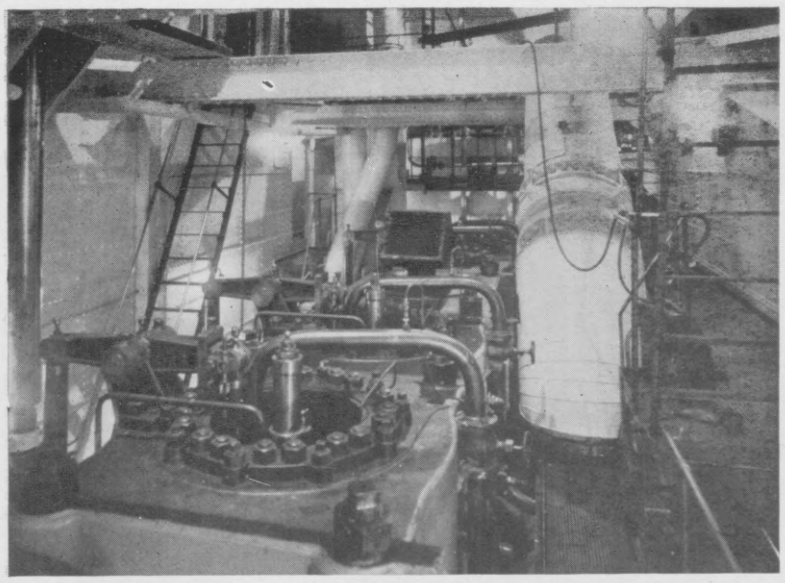
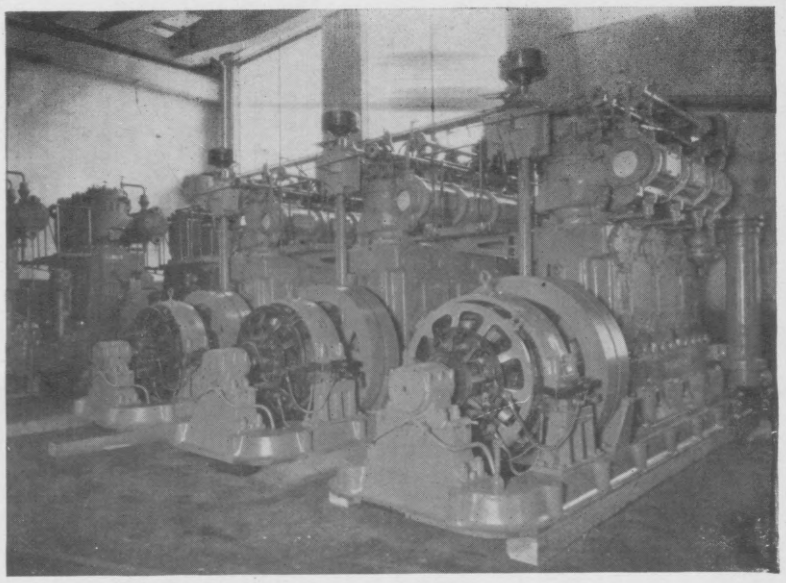


Cylinder tops of the 4-cylinder 3680 hp. Hamilton M. A. N. Diesel



A battery of 75 kw. Worthington auxiliary sets

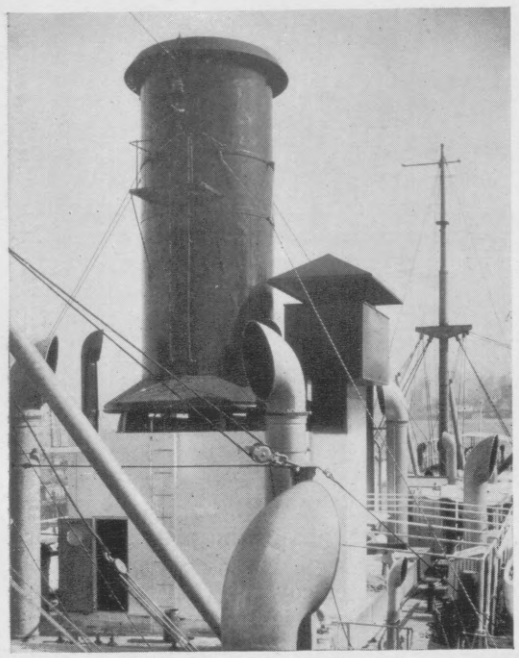
A feature of the starting valves is that they are arranged to stay shut during all periods when the pressure in the cylinder exceeds the pressure of the starting air supply. With this precaution it is deemed permissible to allow the fuel pumps to operate during the engine starting period.

The engine operates on the M.A.N. patented system of scavenging and in the main follows the details of construction we were able to publish in our issue of last March.

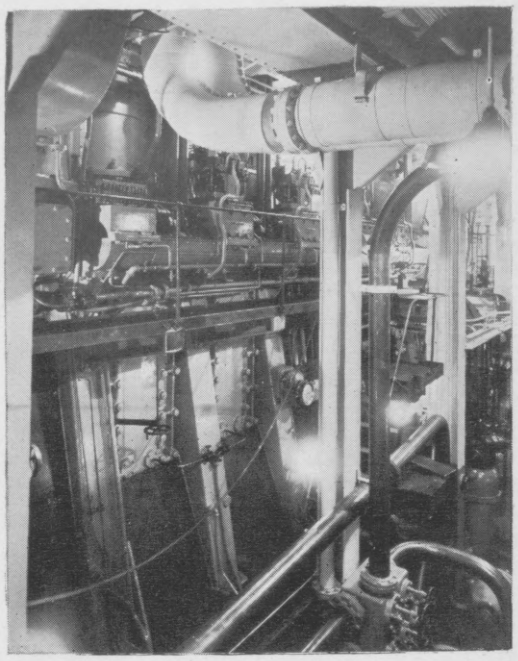
Characteristics of Hamilton-M.A.N. Double-acting Diesel

Total power	3680 b.hp.
Speed	115 r.p.m.
Number of cylinders	4
Cylinder diameter	27½ in.
Piston stroke	47½ in.
Height above shaft center	28 ft. 0 in.
Propeller (4-blade)	16 ft. 3 in. diam.
	12 ft. 0 in. pitch

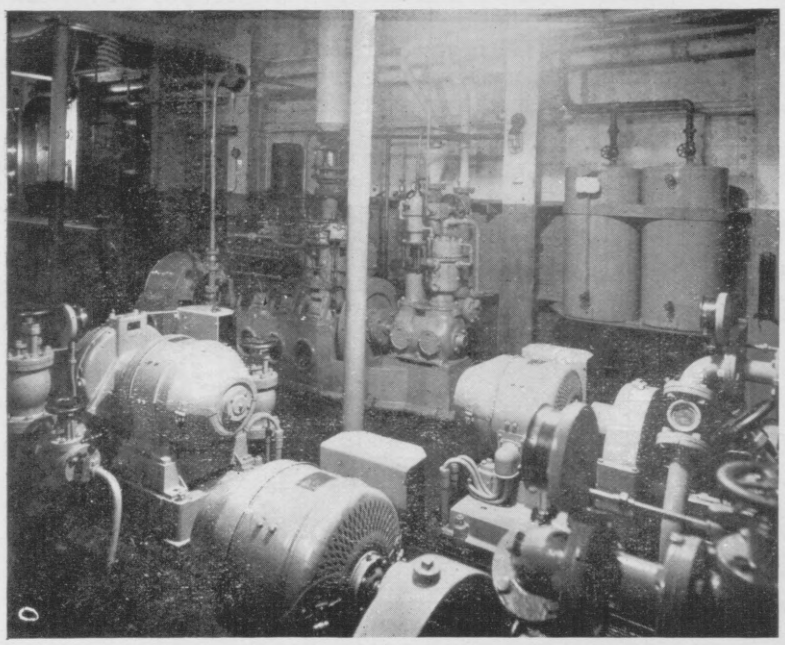
The auxiliary equipment of the ship is principally the same as that which has been fitted in previous conversions and includes Worthington 75 kw. auxiliary generating sets, Nash water service pumps, Kinney oil pumps, with G. E. motors, York-Diehl refrigerating machinery, Sperry "metal mike" and rudder control, Lidgerwood winches with Westinghouse motors and Cutler-Hammer controls, and Walter Kidde fire extinguishing system. The Nash Pumps, Kinney pumps, steering gear control, winches, winch control circuit, winch control equipment mounting, electric heaters, and whistle, were all especially designed.



Showing the stack, bigger than in previous conversions, and scavenge air intake



Control side of the big Hamilton M. A. N. main propulsion unit



Nash pumps, Kinney pumps, and G. E. motors in the engine room

View from the forecastle showing modern winch arrangement

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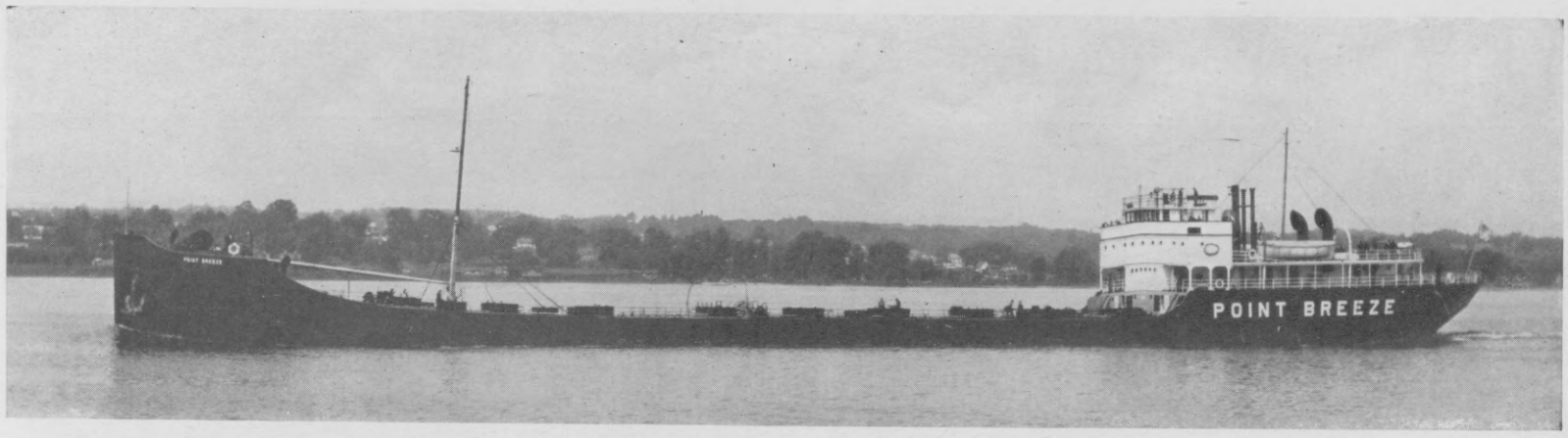


Atlantic Refining Co.'s All Electric Ships

Converted from Steamers, Three 7,000 Ton Vessels Are Now Among Most Progressive and Up-to-date Expressions of Marine Propulsion in the World

COMPLETION of the Diesel-electric tankers POINT BREEZE, SHARON, and BESSEMER marks the advent of three of the most modern ships at present operating as sea-going freighters. Information as to the equipment of these ships has so far been rather meager, but we are now able to give a skeleton sketch of the ships, embellished with some particularly good pictures. These three ships were originally steam driven U. S. Shipping Board tankers. Purchased by the Atlantic Refining Co., owners of the Diesel-electric tanker J. W. VAN DYKE, they were immediately taken in hand for conversion work, the POINT BREEZE at the Point Breeze works of the owners and the SHARON and BESSEMER at the works of the Alabama Dry Dock & Sb. Co., Mobile, Ala. This work included the removal of the whole of the original propelling machinery and boilers and the substitution of Ingersoll-Rand Diesels and General Electric generators supplying current to an 1800 hp. G.E. propelling motor.

Each tanker is now equipped with three 6-cylinder 850-hp., 225-r.p.m., Ingersoll-Rand Diesels, all of 17¾ in. diameter and 22 in. stroke, and driving a 525-kw., 250-volt generator for propulsion and a 50 kw., 250-volt auxiliary generator for excitation and ship's auxiliary power. The propulsion generators supply power to an 1800 hp., 90 r.p.m., 750-volt, double motor on each boat, direct connected to the propeller shaft. The control is of the variable voltage type arranged for operation either from the pilot house or the engine room, the control panels being of dead-front type.

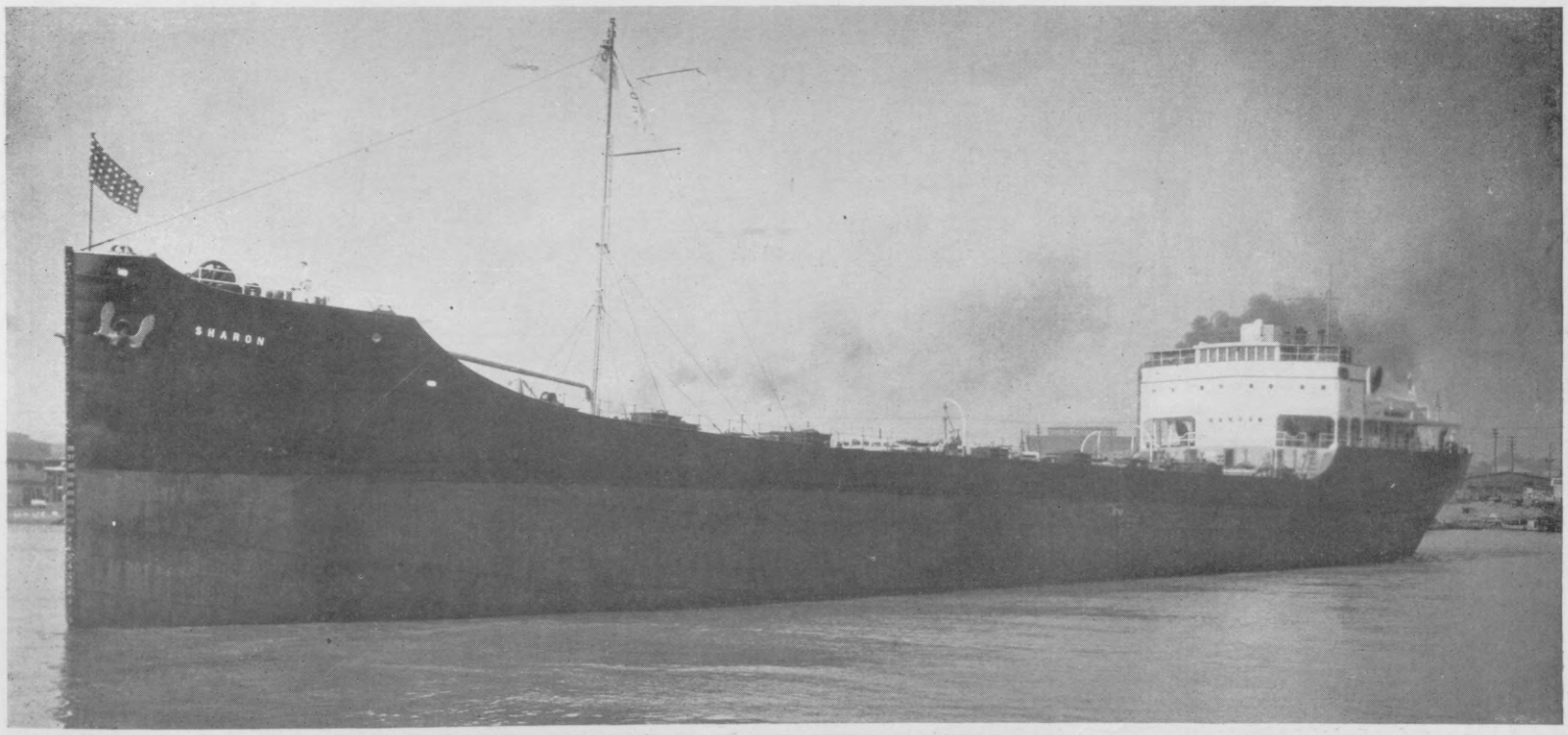
Characteristics of Point Breeze Class

Length b.p.	365 ft. 0 in.
Beam, molded	50 ft. 9 in.
Depth, molded	31 ft. 3 in.
Draft, load	24 ft. 5 in.
Displacement, at above	10,225 tons
Deadweight	7,000 tons
Total capacity main tanks	51,516 bbl.
Total capacity summer tanks	5,922 bbl.
Dry cargo capacity	48,170 cu. ft.*

* Steamer measurement.

The tankers are fitted with electric auxiliaries all of which are driven by General Electric motors. The auxiliaries include two 80 hp. cargo pumps, one 45 hp. windlass, one 30 hp. mooring winch, one 30 hp. fire and bilge pump, two 15 hp. air compressors, a balancer set and numerous small pumps—as well as a 25 kw. auxiliary generator driven by an oil engine for emergency use in port.

The control features form the most interesting part of the ships' equipment. There is on each ship, fitted in the pilot house which entire structure has been moved from 'midships, aft to the poop, one Sperry control unit. This unit is remarkable in that it enables a single man stationed in the wheelhouse to control prac-



The 7600 ton dw. tanker Sharon, with her sister, Bessemer, has been rebuilt from out-of-date steam tanker into 1800 hp. Diesel-electric ships of a most advanced and progressive type by the Alabama Dry Dock & Sb. Co., Mobile, Ala.

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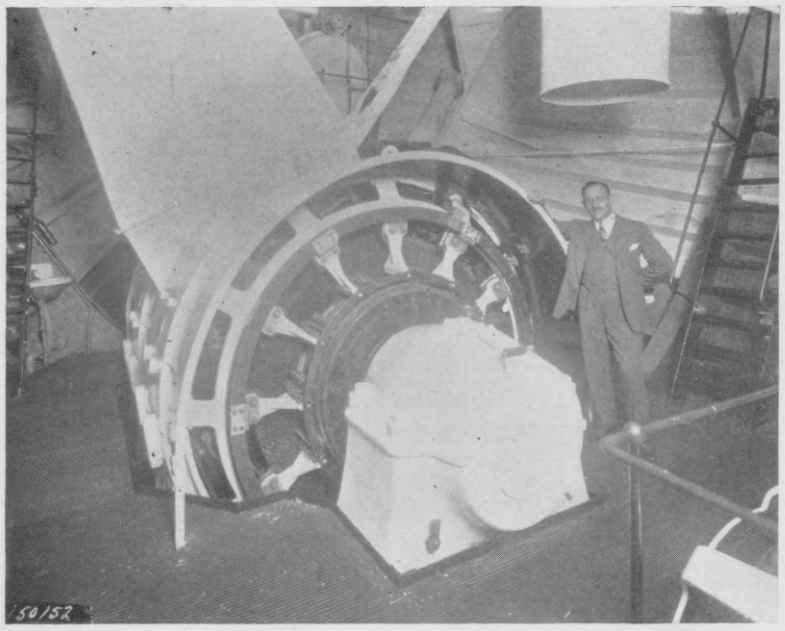
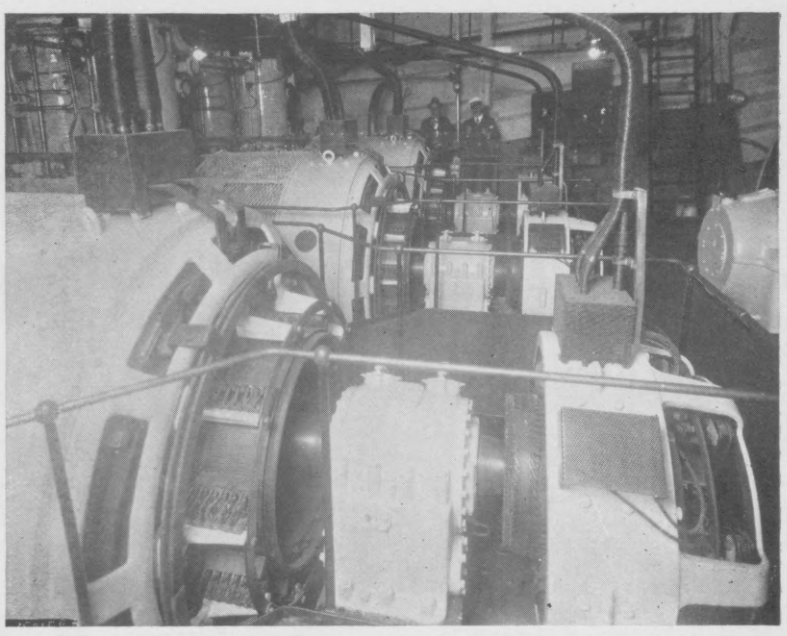
The Atlantic Refining Co.'s 8 Diesel-electric Tank Ships



Lester M. Goldsmith, sponsor of the conversion work, standing beside an 1800 hp. 90 r.p.m. propelling motor



One of the three 525 kw. generators and 50 kw. exciters fitted in each ship converted

In Diesel-electric propulsion, the main prime motive power is also the auxiliary power and the layout is always compact. This shows 2550 Ingersoll-Rand hp. in Diesels and the necessary General Electric generators and exciters in the Point Breeze's engine room—a compact layout

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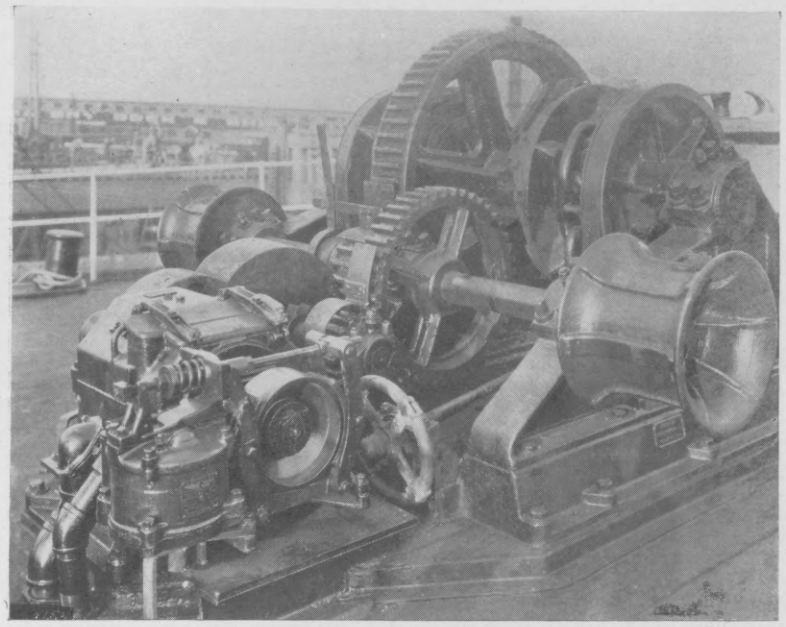
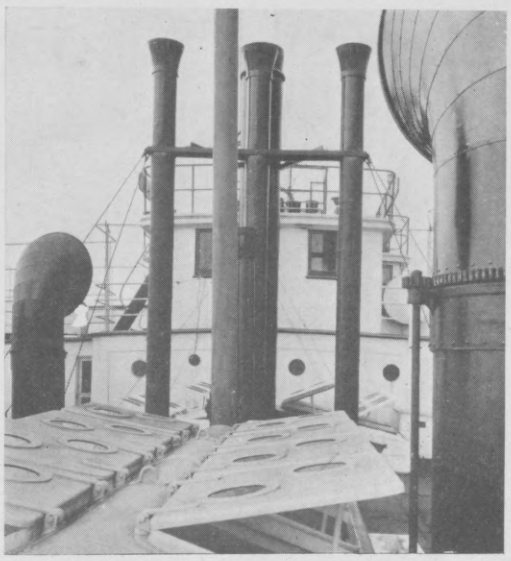


Main 45hp. windlass on the forecastle head

A compact warping winch midships on the main deck

tically every movement of the ship. It provides direct electric control of the ship's motor from the vantage point of the bridge, doing away with the necessity of first signalling down to the engine room and then having the engineers carry out the orders. This direct control of the engine speed is accomplished by simply moving the handles of a controller built on to the top of a standard Sperry gyro-pilot control unit as the illustration shows.

In regard to steering the ship, the gyro-pilot provides a variety of means whereby the rudder may be controlled from the bridge or from aft. The complete steering system includes a gyro-pilot control unit mounted at the normal steering station in the wheelhouse, an electric helm angle indicator and transmitter, and a power unit aft which operates (at the discretion of the control unit forward) the steering-engine valve gear in the steering-engine room.



Exhaust pipes for three main Diesels abaft the pilot house mast

An operating lever with latched quadrant on the side of the control unit permits two alternative methods of rudder control from the bridge: pilot wheel follow-up hand steering, and automatic gyro steering.

In the first method, the small pilot wheel mounted on the after side of the control unit is turned by the helmsman. Any movement of this wheel no matter how small causes a clapper switch aft in the power unit to close, completing an electric circuit to the drive motor, and causing it to turn and move the rudder through the steering-engine valve gear. The movement of the rudder is proportional to the angle through which the pilot wheel is turned.

A novel feature is embodied in that the heat contained in the exhaust gases from the engine cylinders serves to generate steam for heating the heavy cargo oils to facilitate their flow through the pipe lines in unloading.

The main deck is clear from forecastle to poop, because the old midship house has been removed and the bridge is on the poop

View from new pilot house is unobstructed to fore end of ship, and only break in line of hatches shows where former midship house stood

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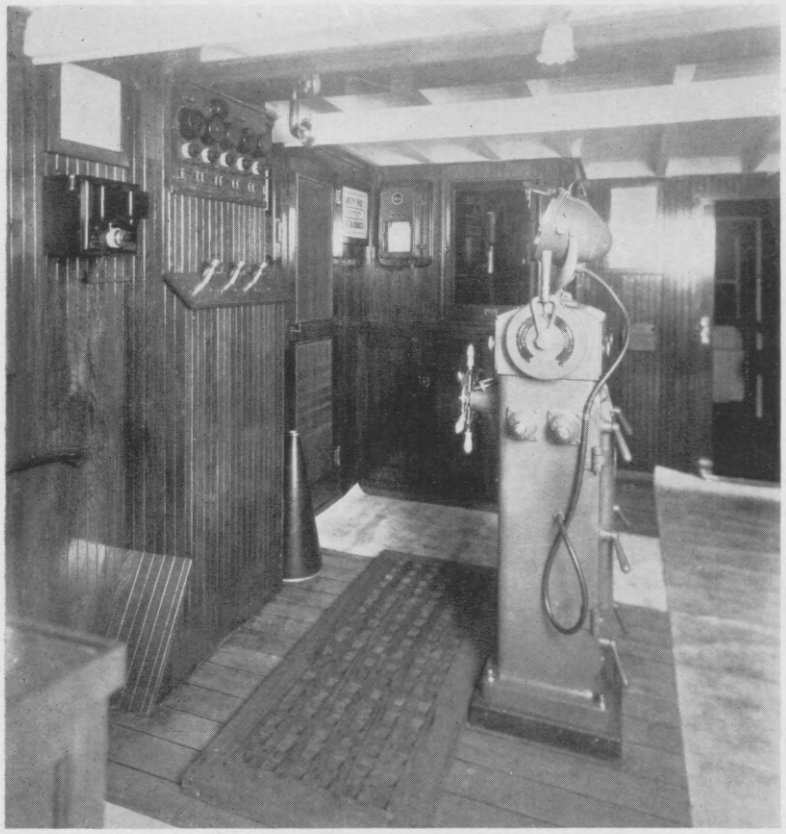
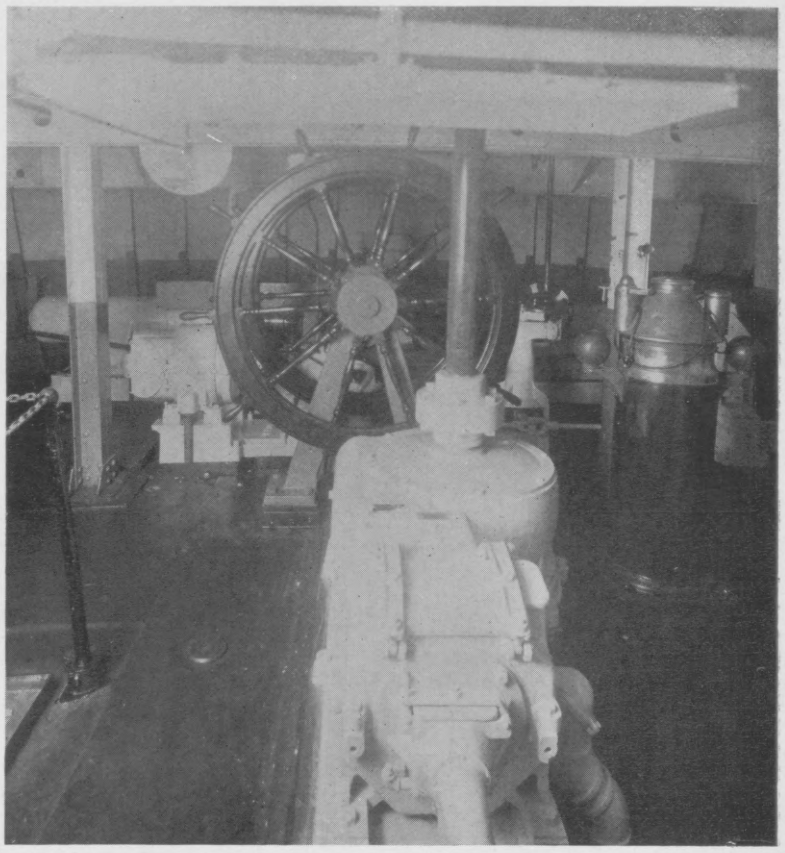
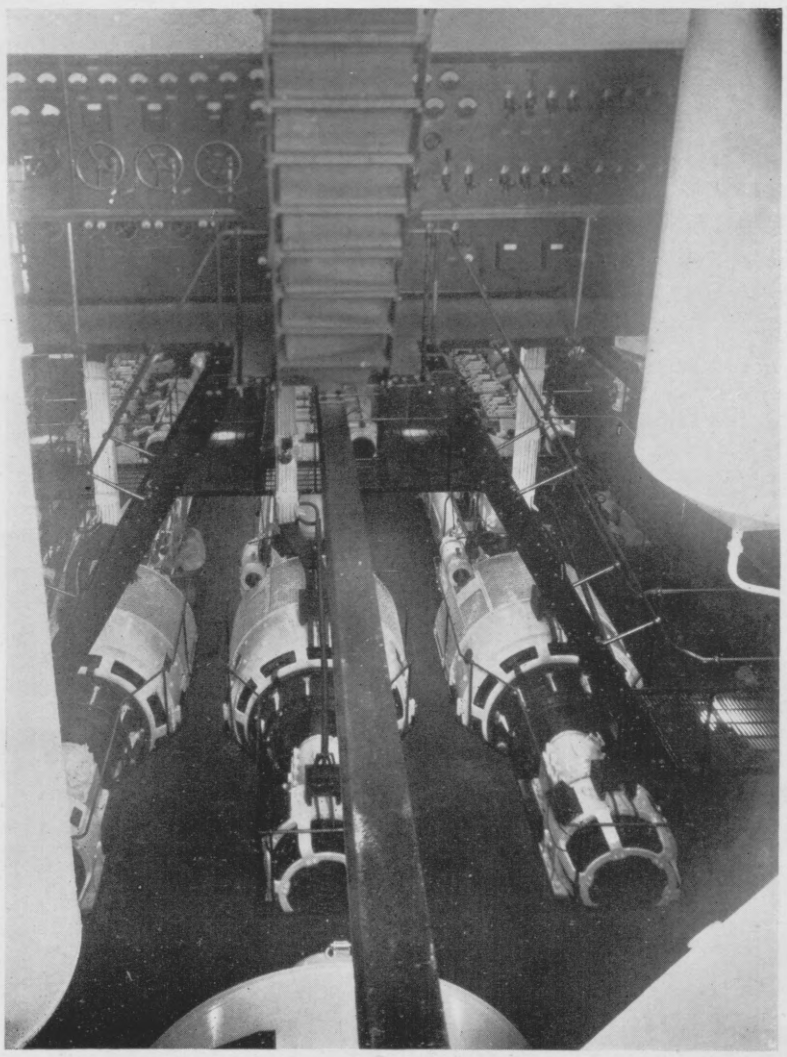
The Atlantic Refining Co.'s 8 Diesel-electric Tank Ships



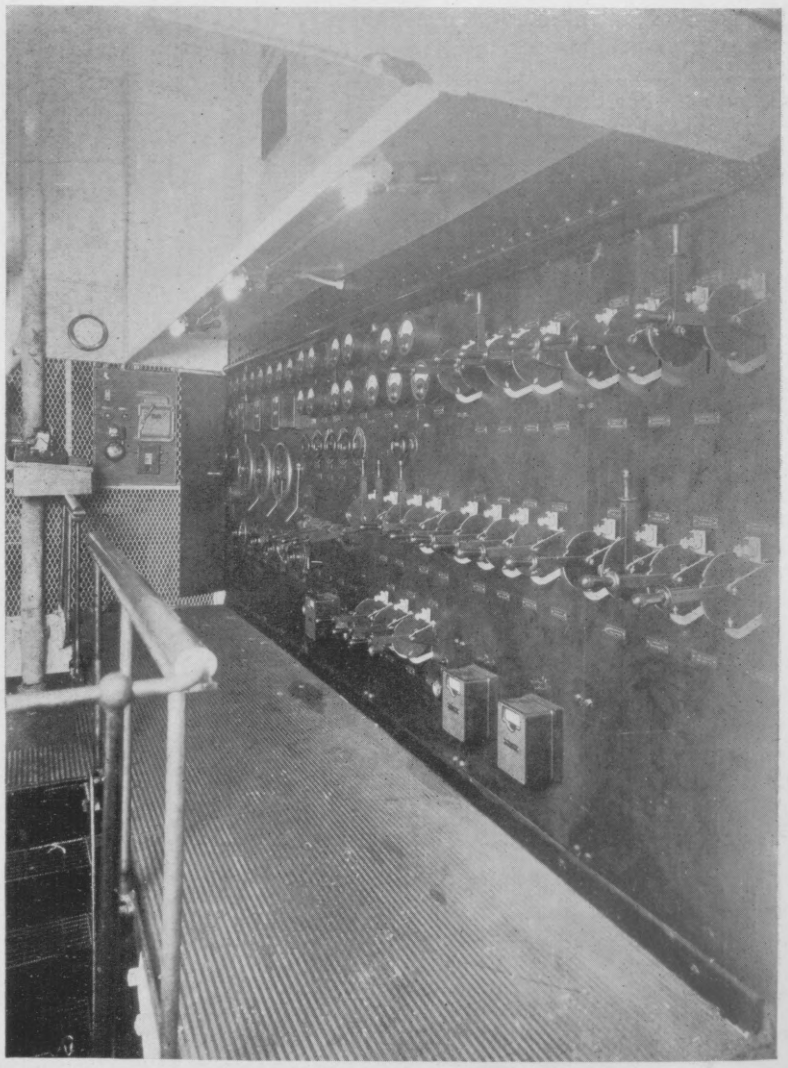
This Sperry dual unit alone controls the speed of the main motor and steers the ship either automatically or manually



The old manual stand-by steering gear and binnacle have been relegated to the recesses of the poop



View looking down on the compact Diesel-electric power plant and (in the foreground) the main motor



The main switchboard, in the upper engine room, combines sturdiness with agreeable simplicity

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World Trade Routes and Specialized Motorships*

Competition, in Conjunction with the Superior Speed and Operating Efficiency of the Motorship, Has Created Special Motorship Types

IT has been shown that the motorship, during the past few years has had a very definite effect upon world trade routes.† The converse of this is largely true, for while motorshipping has been instrumental during the past 3 or 4 years in creating some trade routes, refining and altering others, it has at the same time created of itself, and for itself, definite groups of specialized tonnage. This is yet one further step away from old steamer practice, for the steamer age had relatively few specialized ships other than bulk oil freighters and carriers of refrigerated produce—meat and fruit. The rest of the world's freight was handled by a large grain-coal-lumber "tramp" group of tonnage of between 5,000 and 8,000 gross tons which the British shipbuilder liked to build by the mile and cut off in required length.

Since then the motorship era has come and with it immense shipping amalgamations and combines. Competition has increased at an alarming rate and the old, more or less leisurely, tramp steamer days have disappeared. Competition has necessarily been born of the formation of these gigantic combines, but it has been reared and fostered by the motor driven ship. The motorship *per se* makes for finer, cleaner, and faster transportation of freight. Because one company had a fleet of 12 knotters engaged in service between, say, New York and Brazilian ports, a rival felt it necessary to put in service a fleet of 14 knotters. The next logical step was for the first company to construct a fleet of 16 knotters . . . . . and so the race has gone on. A 16 knot motorship or even a 14 knot ship is an expensive piece of mechanism. It is a fine piece of construction and can logically attract, and expect to get, passengers, partly because of the fast transportation it can offer them and partly because the passenger's fare helps to pay the larger fuel bill. Even bulk oil freighters with 12 or 13 knot speed are now beginning to think in terms of a few passengers, which again seems quite logical and which in all cases has a reflex action upon the construction and operation of the ships themselves. If initially an attempt is made to attract passengers, then conversely the fact that passenger transportation is part of the ship's raison d'etre makes for a well built, well found, ship maintaining liner schedules.

The amalgamations which have recently taken place involving the cohesion of big blocks of capital naturally make it possible for companies to design and operate motorships exclusively for special trades and routes. Now that the motorship has opened up new districts—notably for example California—involving the transportation of new cargoes—again for example the fresh fruits of California—it requires special characteristics to suit the transportation of these special cargoes. This is all tending to the construction of specialized motorships with individual powering and layout problems.

Bulk oil freighters and refrigerated meat-carrying ships were the earliest specialized cargo carriers and they really share this honor from the point of view of date, one of the earliest consignments of insulated cargoes—30 tons of beef and mutton from Australia—having been landed from the steamer STRATHLEVEN in 1880. About this time, the oil tanker was beginning to evolve from a ship carrying a series of tanks in the hull itself, into the definite tank structure as we know it today. This, of course, was long before the motorship had begun to make its presence felt on ocean trade routes; some time before the 14 knot motor cargo liner with refrigerated space had made it possible to eat the fresh fruit of California in British homes, and long before the superior speed of the motor oil tanker had made it a working proposition for the oil transporting companies to provide accommodation for a limited number of passengers in their ships. It has taken from 1880 until 1927 for anyone to realize the potentialities of the Diesel engine sufficiently to produce a fleet of 10,000 ton d.w. tankers with a service speed, religiously maintained, of 12 knots. This the Anglo-Saxon Petroleum Co. has done, installing in each ship one double-acting 4-cycle Diesel of 3,500 hp. turning at the slow speed of 95 r.p.m.

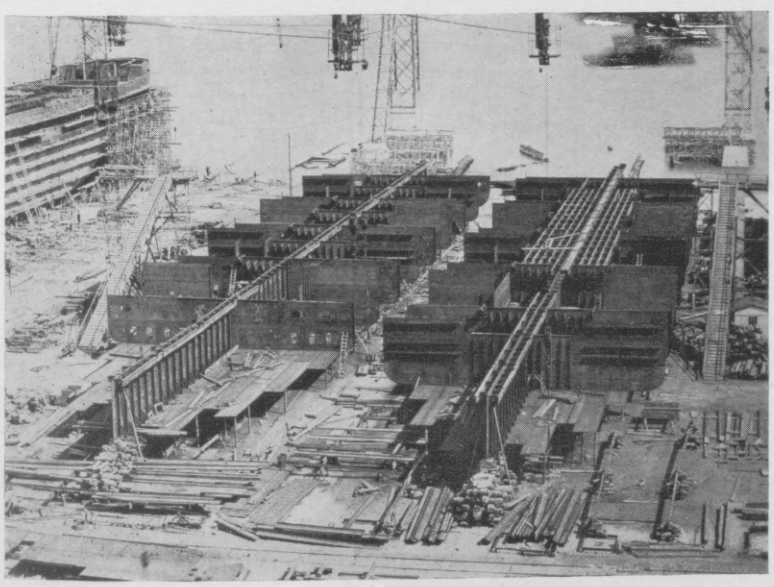
The tanker of over 10,000 tons d.w., while not unknown by any means 10 years ago, was not common. Today big coastwise tankers of 12,500 tons are on service on the American Coast and in transatlantic service—powered with Diesel engines. On the other hand, we can run right down the scale to the little 4,600 bbl. capacity San Francisco Bay runabout tanker and still find Diesel power.

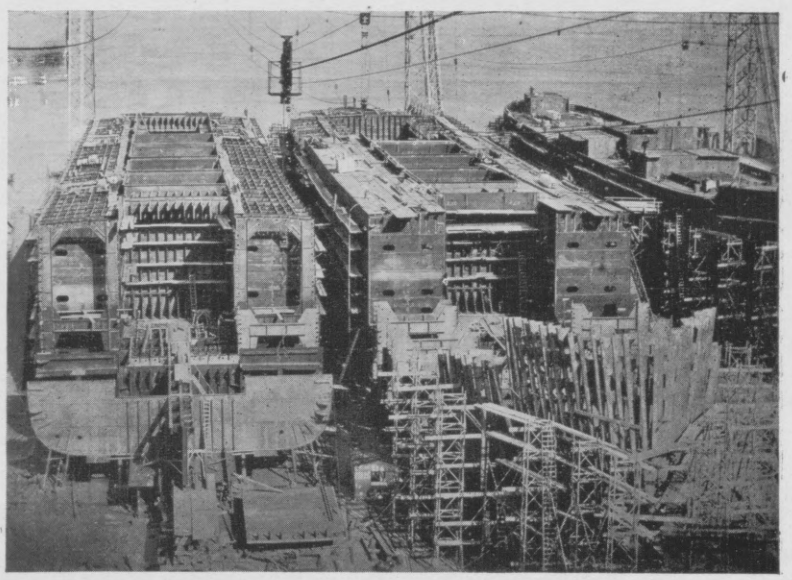
The "Pacific Coaster"

We have said that motorshipping marks a new era in sea transportation. How many of us realize to the full exactly what this means? The motorship has refined and modified world trade routes. This has had a reflex action on the motorship because the refined trade route requires a "refined" instrument of transportation on it. Hence the tendency to eliminate the old tramp. Pacific Coast—U. K.-Continent Services, New York-Round-the-World Trade, South America-New York coffee transportation—all these are evolving special types of fast cargo ships with modern equipment. The meat ship and the oil tanker—specialist ships of the old steamer days—are being augmented by new motorship types such as the "Pacific Coaster."

* A further contribution to our specially prepared series of articles dealing with the present position of the motorship in relation to sea transportation and with motorshipping as marking a new era in sea transportation.

† See "The Motorship in Relation to World Trade Routes" by A. C. Hardy, B.Sc., published in the November issue of MOTORSHIP.





Phases in the construction of Svealand and Amerikaland, world's larges bulk freighters and specialized motorships, powered by 4500 hp. Diesels

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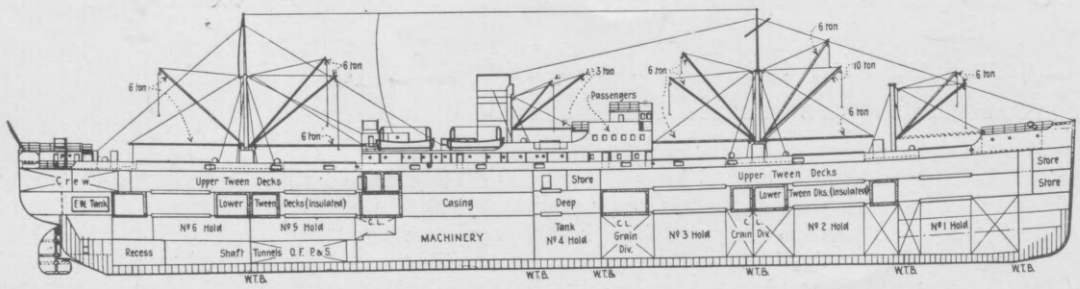
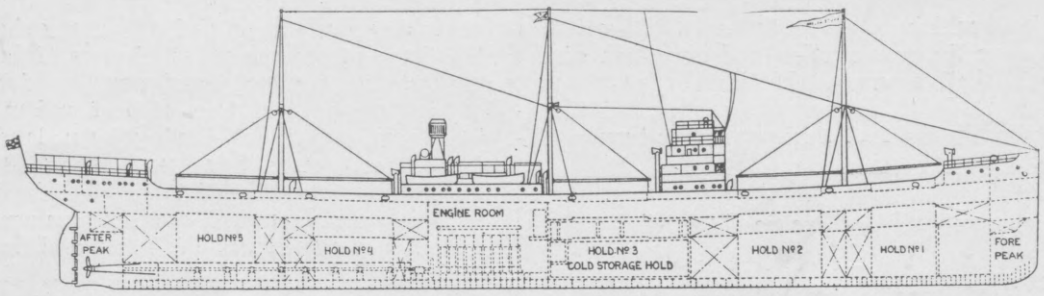
Modern Specialized Motorships Arrangements, Characteristics and Accommodations



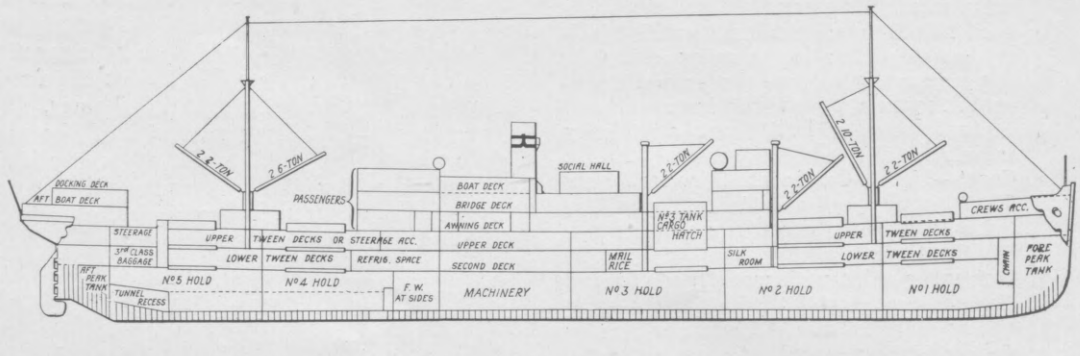
"Pacific Coaster"

Length bp	451 ft.
Beam mld.	60 ft.
Depth mld. to shelter dk	42 ft.
Deadweight	10,000 tons
Total power	4,200 h.p.
Refrig. space	7,500 cu. ft. (lower 'tween dks.)
Passengers	14



"Pacific Coaster"

Length bp	435 ft.
Beam mld	56 ft.
Depth mld. to shelter dk	36.5 ft.
Deadweight	10,355 tons
Total power	5,600 hp.
Refrig. space	No. 3 hold
Passengers	None

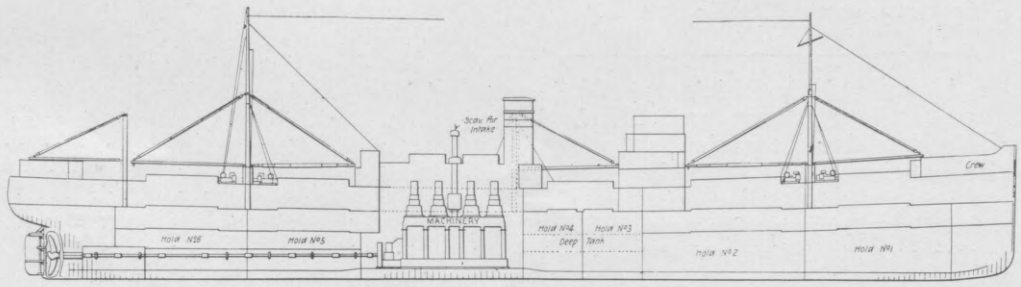


"Round-the-Worlder"

(via S. Africa and S. America)

Length bp	430 ft.
Beam mld	56 ft.
Depth mld to shelter dk	36 ft.
Deadweight	6,000 tons
Total power	4,600 hp.
Passengers	36 first

Large steerage acc. silk room, and rice room.

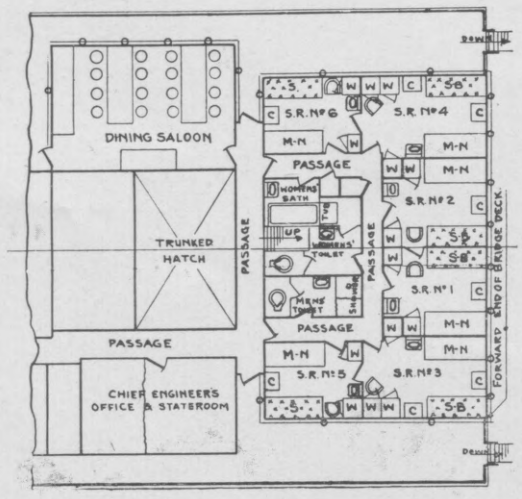


"Round-the-Worlder"

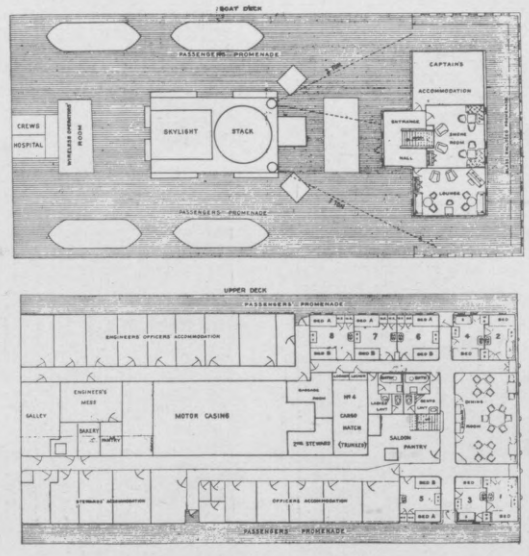
(via Panama and Suez)

Length bp	442 ft.
Beam mld	58.2 ft.
Depth mld. to shelter dk	38.5 ft.
Deadweight	9,000 tons
Total power	5,500 hp.
Passengers	None
Refrigeration	1500 tons

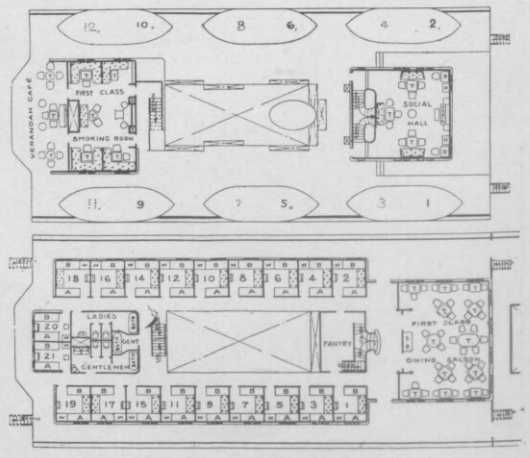
Typical Passenger Accommodations on Existing Fast Specialized Diesel Driven Freighters



A 14-passenger layout on U. S. Shipping Board motorship



A 14-passenger layout on Furness Pacific freighter



A 36-passenger layout on Osaka Shosen Kaisha fast motor freighter

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Powering Details 12,000-12,500 ton Dw. Motor Tankers

Total S.hp.	Type of Engine	No. of Engines	Bore	Stroke	No. of Cyls.	R.p.m.
3800	4 cyc. S. A.	2	21.6	39.14	6	110
3200	4 cyc. S. A.	2	27.0	47.0	6	115
3200	4 cyc. S. A.	2	26.4	47.2	6	110
3000	2 cyc. S. A.	2	25.5	51.2	4	92
2700	2 cyc. S. A.	2	23.6	41.7	4	110
2800	4 cyc. S. A.	2	25.6	39.4	6	125
		10,000-Ton Dw. Motor Tankers				
[1] 3500	4 cyc. D. A.	1	32.2	59.0	6	95
3000	4 cyc. S. A.	1	——	——	6	105
2900	2 cyc. S. A.	1	27.0	60.0	6	85
2500	2 cyc. O. P.	1	22.8	91.3	4	72
2700	2 cyc. S. A.	2	23.6	41.7	4	110
2500	4 cyc. S. A. [1]	2	24.5	39.0	6	118

[1] Airless Injection.

As a matter of fact, some tankers are a difficult problem for Dieselization, because they require steam anyhow, particularly when they carry crude oil and fuel oils in bulk. The tanks in which these rest during transportation have to be steam heated because a "thick" crude or fuel oil cannot be pumped during cold weather. In a 10,000 ton d.w. tanker this necessitates a boiler or boilers of reasonable steam output, and a natural result has been that owners have fought shy of electric auxiliaries in their engineroom because they have to have an amount of steam on tap anyway and it seemed very logical with slightly larger boilers to run the whole of the auxiliary machinery on steam . . . . . Then, too, they had heard nasty stories of sparking from electric motors geared to main cargo pumps. Some have even gone so far as to disregard the big economies of the Diesel for main propulsion. This, fortunately, is not a very prevalent fashion. One logical step for motortankers which require to have steam has been, where possible, the use of waste heat boilers or boilers fired from the exhaust gas heat of the main machinery. Some remarkably efficient results have been obtained in this way.

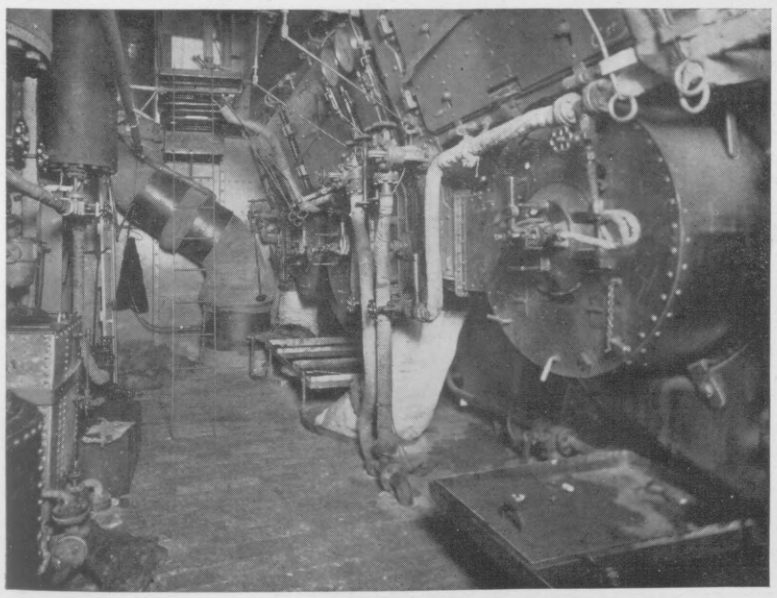
On the trial runs in 1924 of the 2,200 Werkspoor hp. tanker WELLFIELD two 2-furnace, 10 ft. 6 in. diameter, 1200 sq. ft. heating surface boilers supplied steam at 100 lb. to drive an air pump (for auxiliary condenser) a feed pump, a main engine jacket, water cooling pump (operating as an auxiliary condenser circulating water pump) a dynamo engine, and the steering engine. The last two are, of course, real important auxiliaries to the working of the ship. The others are merely the inevitable "family" which "steam" has to carry around with it. Exhaust gas passed into the boilers under the ordinary fuel oil burners at a temperature of about 375 deg. C. It must be admitted that a ship of this type can be operated, at sea, very economically. Modern thought, however, seems to be away from all-steam auxiliary layouts, even in heavy-oil tankers in favor, of all-electrical auxiliaries. The heating boiler when fitted, is a separate unit in a great many cases. In as many cases, almost, a special exhaust heat boiler—such as the Clarkson thimble tube type—is fitted in addition. This seems to be favored rather than passing the gases through the main boilers.

No survey is complete without here recalling that the auxiliary drive problem was solved in an ingenious manner on the 8000 ton German tanker URANO, a twin-screw motorship of 1900 hp., in which all auxiliaries other than the engine driven cylinder and piston cooling pumps, lubricating oil pump, and bilge pump, could be driven either by steam from an auxiliary boiler, or by compressed air, or by a combination of steam and compressed air. The compressed air is supplied by a special Diesel driven compressor at the aft end of the engine room, used also for supplying maneuvering air. The cargo pumps can be operated by steam or by compressed air. The steering engine is operated by compressed air from two special compressors driven off the main engines. One of two small oil engine driven generators supplies current for ship lighting.

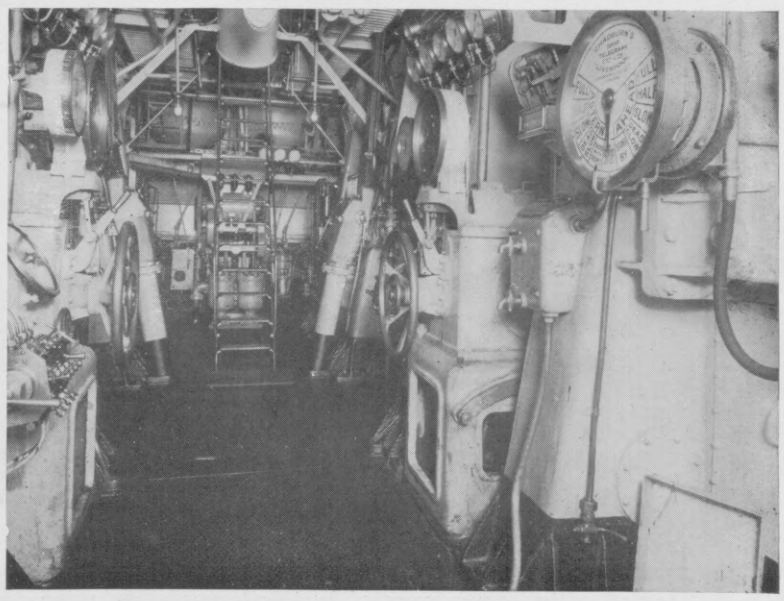
One of the factors which has led to the gradual establishment of electricity for auxiliary drive is the now established fact that there is practically no sparking danger from suitably arranged main cargo pump motors. Neither is it necessary to arrange the motors on the opposite side of the bulkhead to the pumps. This practice, is, however, still followed out in small "bay" type tankers intended for the carriage of gasoline in bulk. You've got to have electricity about on a modern ship anyhow and the logical thing seems to be to fit Diesel driven generators with their low operating cost. Remember, too, that at sea one auxiliary generator takes care of the needs of the whole ship provided the main engine or engines are properly self contained. Thus there seem to be few reasons why a belt driven generator should not be fitted, reducing the present number of separately driven generators to one. This is true, of course, of any freight carrying ship of up to about 8-9000 tons d.w.

Then, of course, tankers which carry gasoline and white oils do not require to carry steam for any purpose other than ship heating. These are an increasing number, the demand for the type of oil they carry being so big as to justify the construction of ships specially for the purpose. Standard Oil interests, ever watchful where tanker developments are concerned took delivery of a remarkable moderate sized vessel in 1927. This vessel, the GENERAL GASSOUIN of 6550 tons d.w. has 14 cylindrical tanks (7 pairs) extending from the double bottom to the upper deck. Forward and aft of these tanks respectively is a pair of tanks built on the ordinary tanker system. There is no pump room in the ordinary sense of the word, but five small motor driven rotary pumps for cargo handling are arranged between the tanks on the centerline of the ship. The ship is intended primarily for transporting gasoline between Bayonne, N. J., and Rouen, France. She has an 1850 hp. Sulzer Diesel.

The most outstanding development in tanker powering of recent years has been the fitting of a single 3500 hp. double-act-



Exhaust gas boiler firing arrangement in a tanker



Twin opposed piston engine controls in a meat ship

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Hull Particulars and Dimensions of Typical Diesel Bulk Freighters

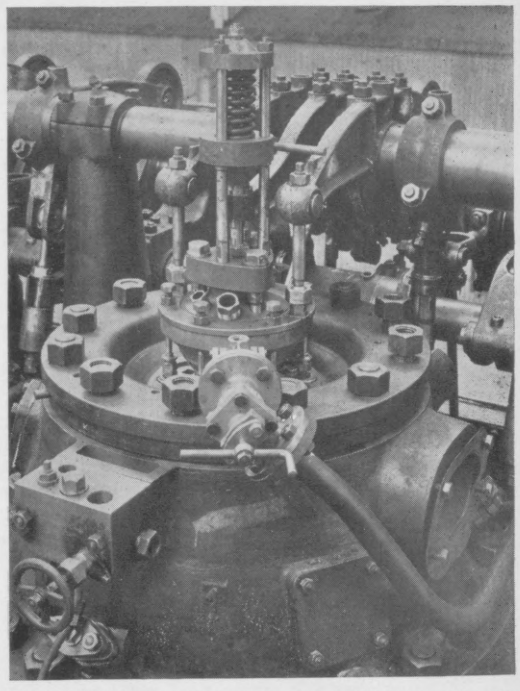
	Name	Duty and Service	Reg. Dims. L	B	D	Tonnage	Special Features
A	Amerikaland ..	Ore carrier, Chile-U. S.....	561.3	72.0	46.6	20,600 Dw	Mach. aft
A1	————	Oil tanker	492.0	64.0	37.0	13,000 Dw	Mach. aft
B	Athelchief	Molasses carrier, Java-U. S..	475.0	62.2	35.5	12,000 Dw	
C	Bulysses	Oil tanker, U. S.-U. K.....	440.0	59.0	32.7	10,000 Dw	
D	Silurian	Transatlantic grain trade....	431.2	57.2	30.7	11,000 Dw	Mach. aft
E	Pajala	Ore carrier	418.8	55.1	33.6	10,500 Dw	Mach. amid
F	Belpareil	Locomotive and grain carrier.	410.0	60.5	33.5	10,375 Dw	Mach. aft
G	Mundoo	Australian collier	331.8	46.5	23.1	5,100 Dw	
H	Margretian ...	Coal and grain.....	297.8	43.6	21.5	4,500 Dw	Mach. aft

Machinery Particulars of Typical Diesel Driven Bulk Freighters

	Name	Power	Speed	No. of Engs.	Bore	Stroke	R.P.M.	Type	No. of Cyls.
A	Amerikaland	4,500 S	11¼	2	29.13	47.25	115	4 cyc. S. A.	8
A1	————	4,500 I	—	2	——	——	——	4 cyc. S. A.	—
B	Athelchief	3,800 S	—	2	21.6	39.1	110	4 cyc. S. A.	6
C	Bulysses	3,500 S	12	1	32.2	59.0	95	4 cyc. D. A.	6
D	Silurian	2,800 S	11	2	24.4	38.4	125	4 cyc. S. A.	6
E	Pajala	2,600 S	11	2	26.4	39.4	115	4 cyc. S. A.	6
F	Belpareil	2,750 S	11	2	23.6	41.7	110	2 cyc. S. A.	4
G	Mundoo	2,500 S	10½	1	24.8	51.8	95	4 cyc. S. A.	8
H	Margretian	1,200 S	11	2	18.0	24.0	185	2 cyc. S. A.[1]	6

[1] Cold Starting Beardmore engines.

A selected group of Diesel driven bulk freighters for all duties shows not only a large variety of engine types and sizes, but also something of the varied duties the motorship performs. We have seen something already of the tendency of modern tonnage. The motorship is accentuating this and is now carrying most of the world's specialized cargoes, not the least significant of which is the carriage of coal on the Australian coast. A large Australian colliery owning company operating from Newcastle, N.S.W. actually find it more profitable to transport coal in Diesel-engined ships, on a coast where oil is not at its cheapest, than to employ steamers with their greater fuel consumption and larger engine room staff, this latter being an important point in Australia where labor conditions are difficult in the extreme. Most of the examples selected as typical Diesel driven bulk freighters are well known ships whose performance records have more than justified the outlay and the care worked into their design.



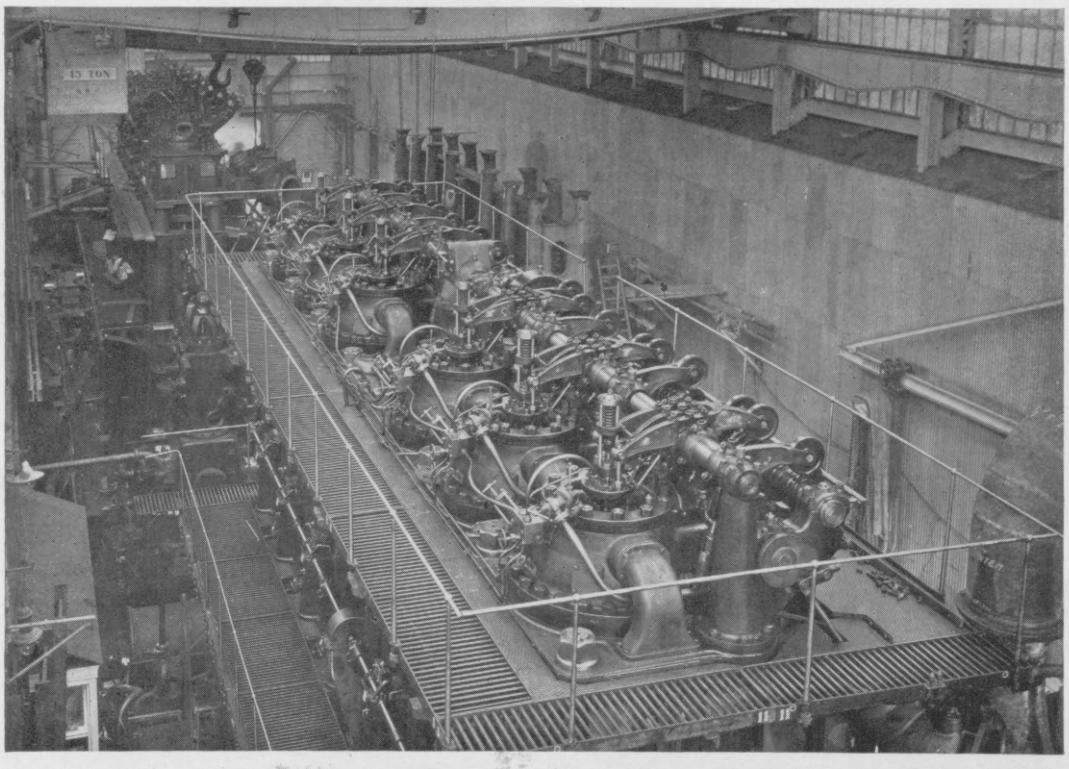
Special valve arrangement on 3500 hp. double-acting 4-cycle Diesel

In particular the German-built, Swedish-owned, American-operated ore carriers SVEALAND and AMERIKALAND are worthy of mention as having a 20,600 tons deadweight capacity and 4500 s.hp., their two big 8-cylinder, single-acting, 4-cycle engines having a stroke of 47.25 in. and operating at 115 r.p.m., at which they can propel the ship loaded at 11¼ knots or in ballast at 12 knots. Since commissioning in 1925, both these fine motorships have been in service transporting ore from Cruz Grande in Chile to Claremont, N. J., or Sparrows Point, Baltimore, on a very rapid schedule, via the Panama Canal. They run in conjunction with a number of steamers and reports from the SVEALAND prove that the motorships are not only more economical than the steamers in the same trade, but that they handle better, although it is true that this superiority comes partly from the benefit of experience gained by the steamers, which were built first.

On her first transit through the Panama Canal, Ms. SVEALAND was watched pretty carefully and on her way through the Culebra Cut a tug stood by for emergency.

ing, 4-cycle Werkspoor Diesel to each of the units of the big 10,000 ton Anglo-Saxon tanker fleet. The engine itself is unique as being one of the few long-stroke, slow-running, double-acting Diesels in existence, thereby incidentally going a long way towards satisfying the old steam man's plea for something "plain and homely." But there's more in it than that, fortunately. A policy of choosing one definite type of engine for a complete fleet secures for the owners a wonderful interchangeability of spare parts as well as of personnel which can never be enjoyed by companies whose fleets are powered by three or four different types of machinery. It may be argued that it was a bold piece of work thus to mortgage the fortunes of a whole fleet to the vagaries of one type of engine, and "one engine per ship at that," one can imagine the pessimist saying. Operating results so far seem to have hung the garlands of success round the neck of Mr. Zulver's image of standardization. Furthermore, note that for example B in the table of bulk motorships as little as 300 extra horsepower requires two 6-cylinder, single-acting, 4-cycle, single-acting Diesels, whereas it might have been obtained with a 6-cylinder, double-acting engine of different make to that in example C.

Powering is no more standardized in tankers than in any other type of ship at the present time. The table of powering details shows what a wide diversion of arrangement there is in two groups of six tankers, the members of each having the same capacity. It is difficult to discover any definite relation between powers, r.p.m., and cylinder dimensions. Even ships fitted with one engine only vary in r.p.m. between 95 for a 3500 hp. double-acting unit to 118 for a single-acting airless injection 4-cycle unit.



A complete fleet of tankers is powered by this type of Workspoor double acting 4-cycle Diesel developing 3500 s.hp. at 95 r.p.m. This engine has a special valve arrangement

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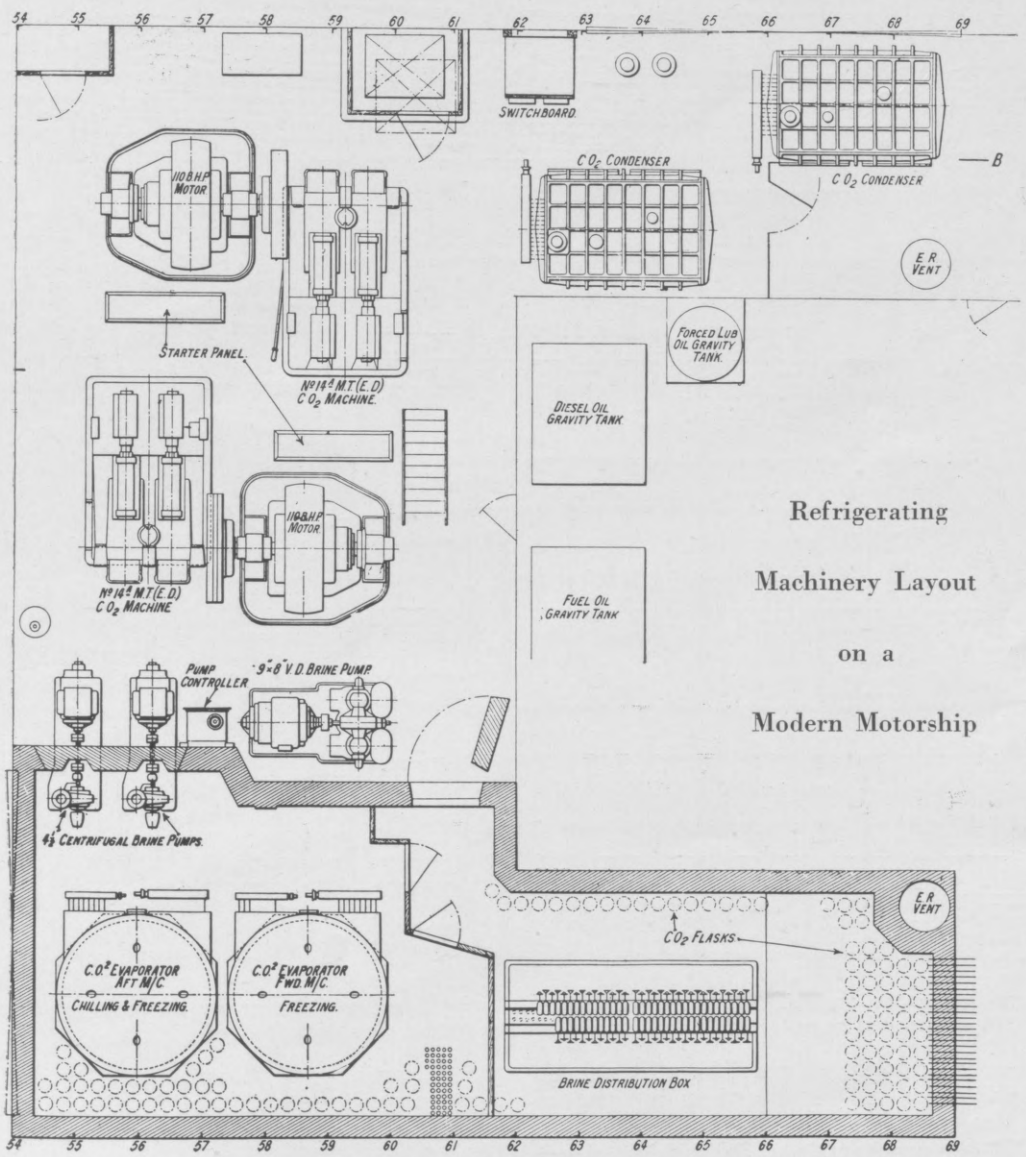
Hull Particulars and Dimensions of Typical Special Motor Freighters

	Name	Duty and Service	Reg. Dims. L	B	D	Tonnage	Special Features
A	Port Hobart	Meat carrier, Aus. & N. Zeal.	466.9	59.5	31.3	10,800 Dw	297,00 cu. ft. refrigerating space
B	Javanese Prince	Gen. cargo, N. Y.-Far East	440.0	60.0	29.2	10,000 Dw	"Round-the-worlder"
C	Upwey Grange	Meat carrier, U. K. & S. Amer.	430.0	62.3	38.3	9,130 G	———
D	Primero	N. Y.-S. America (General)	368.5	53.5	24.9	6,700 Dw	"South Americaner"
E	Moveria	Meat & Cattle carrier, U. K.-Pacific Coast	385	51.5	39	7,500 Dw	All accommodation amidships. Ship now operating in Pacific Coast trade
F	Pacific Reliance	"Pacific Coaster," U. K.-Pacific Coast	451	60.0	42	10,000 Dw	Specially designed ship


54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69
SWITCHBOARD
110 B.H.P. MOTOR
CO2 CONDENSER
CO2 CONDENSER
B
E.R. VENT
STARTER PANEL
No 14 MT (E.D.) CO2 MACHINE
FORCED LUB OIL GRAVITY TANK
DIESEL OIL GRAVITY TANK
110 B.H.P. MOTOR
No 14 MT (E.D.) CO2 MACHINE
FUEL OIL GRAVITY TANK
PUMP CONTROLLER
9"×8" V.D. BRINE PUMP
4½ CENTRIFUGAL BRINE PUMPS
CO2 EVAPORATOR AFT M/C CHILLING & FREEZING
CO2 EVAPORATOR FWD. M/C FREEZING
CO2 FLASKS
E.R. VENT
BRINE DISTRIBUTION BOX
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69

Refrigerating Machinery Layout on a Modern Motorship

Nearly 300 hp. in electrical motors is used in this refrigerating engine room on a modern motorship to freeze or chill cargo in 397,000 cu. ft. of insulated holds

Machinery Particulars of Typical Special Motor Freighters

	Name	Power	Speed	No. of Engs.	Bore	Stroke	R.P.M.	Type	No. of Cyls.
A	Port Hobart	4,700 S	12	2	21.3	85.0	95	2 cyc. opp. p[1]	4
B	Javanese Prince	7,000 S	14	2	29.1	47.2	125	4 cyc. S. A.	8
C	Upwey Grange	6,400 S	13½	2	28.0	39.0	125	2 cyc. S. A.	6
D	Primero	4,700 S	12	2	19.7	35.4	150	4 cyc. S. A.	6
E	Moveria	2,700 B	12	1	30.0	45.0	110	4 cyc. S. A.[1]	8
F	Pacific Reliance	4,200 B	13½	2	25.0	51.0	115	4 cyc. S. A.	8

Some of the Panama Canal officials accompanied the SVEALAND and found that not only was there no trouble in working this motorship away from the wall after she had passed the Pedro Miguel Locks, where the suction from the approach wall makes it difficult for a large ship to depart, but she steered through the Culebra Cut like a yacht, and the pilot did not have to touch the engines in making the bend.

This was attributed to a couple of narrow curved strips riveted to the after end of the rudder. These form the only under water difference between the motorships and the steamers, and there is no other way of accounting for the greater handiness of the motorships on the Canal.

The average time of a trip between Cruz Grande and New York is about 19 days, and the time to Baltimore is about 7 hours less. At Baltimore discharge can be effected in 16 to 18 hours; at New York the time is about 22 to 24 hours. With such quick discharge and far more rapid loading, the absence of lay-overs at either terminal introduces a special problem of engine inspection and valve replacement. Only serious damage to a ship would be allowed to interfere with the fast schedule. Provision therefore has to be made for overhauling at sea.

When the chief engineer is ready to open one of the engines for inspection or for the routine change of valves, he shuts down an engine for 8 hours. The ship proceeds on a single screw with the loss of about 25 miles in this time. The other engine is overhauled on the next trip. Both these vessels have an average daily fuel consumption of about 19½ tons of 29 deg. Beaumé oil, with an average of 6400 i.hp. at 115 r.p.m. Of the daily total about 18.7 tons are consumed by the main engines and about 0.8 tons by the auxiliary machinery.

The big hatch covers on these ships are made of steel plates semi-circular on either side of a common center line. These open up and provide facility for operation of grab buckets for rapid Great Lakes type unloading at the terminals. Yet these hatches are the staunchest and tightest ever sent to sea, stronger by far than any ordinary freighter has ever been equipped with. In fact, they make the old fashioned wood and tarpaulin hatch coverings, still sanctioned by even the most progressive motorship owners, look like the relics of a Columbus caravel.

The hatches are lifted by ordinary hemp tackle with the aid of electric winches, one winch for each pair of hatches. All the covers can be raised in about 10 minutes. There is no encumbrance of hatch beams or covers around the deck, and the hatch covers are clear of the hold entrances and out of everyone's way until loading is completed. A few minutes and a little careful operation allow them to be lowered into position again.

Water-tightness is obtained by clamping down on thick rubber pads, about 4½ in. wide and 1½ in. thick, round the edge of the hatch cover. Bolts fitting into cleats on the hatch make it possible to screw the covers down tight. With the strength of the steel cover there is no danger of hatches being stove in by heavy seas, however, severe the pounding, an accident which has caused the loss of many a bulk cargo carrier at sea. With the tightness round the edges there is no possibility of cargo dam-

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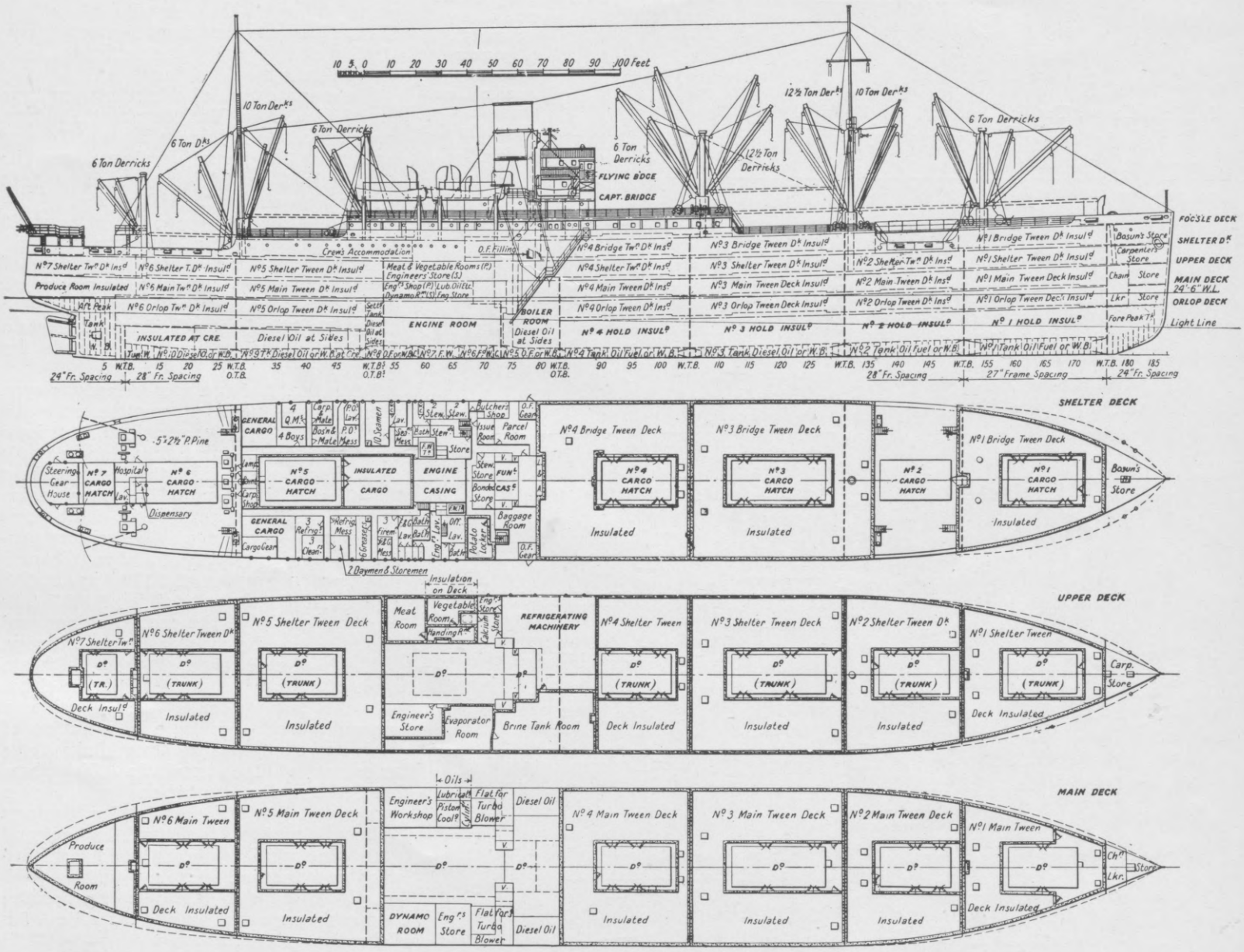
age from external sources of any kind.

Such hatches are criticized for application to freighters carrying ordinary case, package or grain cargo on the grounds they are too cumbersome. There is a certain justification for the criticism, because the upstanding height of the open hatch covers would interfere with ordinary derricks or winches. On the other hand only marine conservatism prevents the consideration of other arrangements of derricks and winches. Certain lumber carriers, for instance, have the derricks and winches raised, the space under the winch platforms being encased to form housings for the electrical resistances and controllers, an arrangement which protects winches, motors and electrical gear from many a swamping and gives the winchmen a better view over the hatchways. This system, as has been pointed out previously, is being used in many modern motor freighters today.

It may seem that undue strees has been laid on the Panama Canal in connection with motorshipping. Its importance cannot be overestimated. Something has been shown already of the effect which the Canal has had upon trade developments in Californian and Pacific North West ports. The Canal was but the channel through which trade could flow. Competition was the spur which made the shipper put on service cargo ships of higher quality. Cheapness of operation, combined with the higher speed available and the better service offerable to shippers, pointed the way for the progressive shipowner to cut out his steamers and substitute motorshipping. Today there is not a steamer building for a major shipping concern for trade to and from the Pacific Coast via Panama. Firms like Furness Withy are busy selling their steamers as fast as possible. They're no use to them and keeping them in the fleet is like trying to run a bulldog in a stable full of greyhounds. Californian fresh fruit, Pacific North West lumber, San Francisco grain, the Coast cannery products—food and building necessities to the world have all combined to produce the "Pacific Coaster."



General arrangement of a well designed fast motorship for the exclusive carriage of meat. This ship has four tiers of tween decks, and has twin Diesels of 6400 s.hp., in a compact engine room abaft amidships, for main propulsion

The "Pacific Coaster"

What is the "Pacific Coaster"? Wherein does she resemble the meat ship? How does she contrast with the "South Americaner" and with the "Round-the-Worlder"? All are, except the meat ship, products of the motorshipping era of sea transportation change. All have been bred by Competition out of Realization—of superior economies. The "Pacific Coaster" proper combines the main features of a grain ship plus those of a meat ship, plus those of a lumber and general cargo carrier.

The "Round-the-Worlder" combines the many 'tween decks of a general cargo carrier with certain features of the oil tanker, while the "South Americaner" is a species of "Limited" express for coffee transportation between Santos and New York. All, because of their speed, cleanliness and general efficiency are ideal as carriers of a limited number of passengers. The meat ship proper is a very specialized ship like an oil. So are they all for that matter in that they would be practically useless in any other trade. But, the "South Americaner" would be useless on North Atlantic or Round-the-World service whereas the meat ship proper could carry beef from the Argentine or mutton from New Zealand to U. K. ports with very little difficulty or change in existing layout. Consider, however, that 15 years ago all this transportation, other than meat transportation came within the province of the dear old general cargo carrier. It still does for unprogressive firms who wonder why they are being slowly pushed off the seas. That is why we say that the motorship has created for itself definite tonnage groups.

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New Motorship Completes Maiden Passage

Big "Pacific Coaster," First of New Furness Withy Fast Fleet, Arrives at Vancouver via Coast Ports

BY OUR VANCOUVER CORRESPONDENT.

PACIFIC RELIANCE, described briefly in the November issue of MOTORSHIP, the first of four new sister motorships which the Furness Withy Co. is adding to the fleet engaged in service from United Kingdom ports to the Pacific coast of North America via Panama arrived at Vancouver on Oct. 23, thus ending the outward portion of her maiden voyage on schedule.

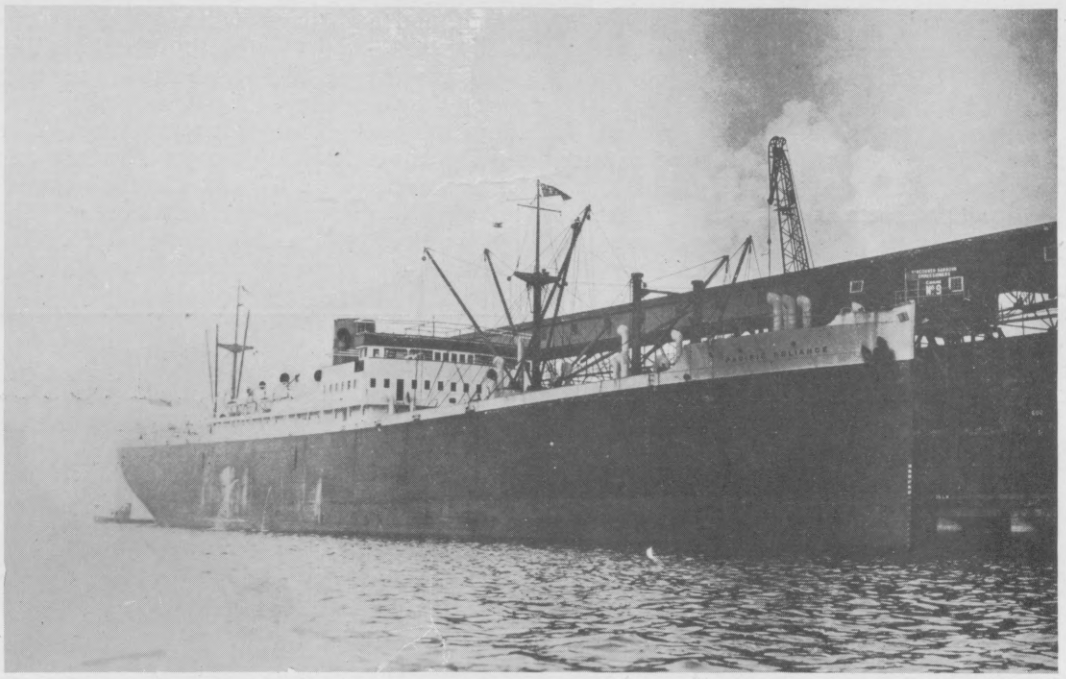
A visit to the ship leaves one with the impression of a clean lined craft of shelter deck type with cruiser stern, and nicely balanced superstructure, having the large low funnel typical of so many of the latest motorships, while a forest of cowl ventilators indicates that a special effort has been made to maintain airy cargo spaces, engine room, and accommodations.

Accommodation for the ships officers and passengers is all amidships, and the crew's quarters right aft, the forecastle being used for stores. A Duct keel forward of the engine room in which piping to double bottom tanks is laid, and through which the tanks themselves are also accessible is a constructional feature now being largely adopted, the tanks aft being accessible through the shaft tunnels.

The layout of the engine room is simple and efficient with all electric auxiliaries with the exception of one small steam air compressor. Three 4-cylinder 250 hp. 165 kw. generator sets, with B. & W. type engines, built by Allan & Sons of Bedford are installed on the starboard side. These Diesel engines are fitted with oversize compressors, so that ample reserve air is available for the main engines when maneuvering.

The CO_2 refrigerating machine for cargo holds is located at the after end of the engine room between the propeller shafts. There is also a smaller machine for ships' stores refrigeration.

On the port side of the engine room most of the pumps are installed. Apart from pumps of the refrigeration system there is an imposing array of pumps for various purposes driven by electric motors. The bilge pumps consist of a Weir pump of plunger type having a capacity of 50 tons an hour, and a Drysdale centrifugal pump, of the same caacity; there is also a Clark-Chapman ballast pump of plunger type, pumping 200 tons an hour. Two centrifugal circulating water pumps of upright type have a capacity of 200 tons each, and two Weir fuel transfer pumps of plunger type handle 30 tons an hour each. Purified oil from the centrifuges is transferred by a centrifugal pump of 10 tons capacity, and fresh water is lifted by a plunger type pump of 20 tons capacity; while there are three Stothert & Pitt rotary lubricating pumps of positive displacement type, having a capacity of 40 tons an hour each.



Ms. Pacific Reliance loading at Vancouver for U. K. ports

Three Sharples centrifuges with a capacity of 1¼ tons an hour each are provided for cleansing the fuel and lubricating oils. One centrifuge is used exclusively on fuel oil, and another for lubricating oil, while the third is interchangeable.

Characteristics of Pacific Reliance Class of Freighters

Length b.p.	451 ft. 0 in.
Beam mld.	60 ft. 0 in.
Depth mld. to shelter dk.	42 ft. 0 in.
Draft (load)	27 ft. 0 in.
Deadweight	10,000 tons
Gross tonnage	6716 tons
Total power	4200 b.hp.
Sea speed	13½ knots
Engine speed	114 r.p.m.
Propellers	13 ft. 3 in. dia. 14 ft. 10 in. pitch
Type of ships	Shelter deck

A new feature that has much to commend it is the installation of a dehydrator for separating the oil from bilge water before pumping the water overboard. The Holford & Harvey (H & H) dehydrator on the PACIFIC RELIANCE is a large cylindrical tank fitted with perforated cones and other devices to control the flow of oily water, the principle of the difference in specific gravity of oil and water being utilized to separate the two. The oil is drawn off the top into a storage tank, and the water after passing through a filter to remove any remaining trace of oil is discharge overboard. The dehydrator is installed forward on the port side of the engine room.

A Clarkson thimble boiler of 2½ tons capacity, built to utilize the heat of exhaust gases from the main engines is placed in the forward end of the engine room immediately below the funnel. It supplies steam for the pantry, for heating the crew's quarters, aft, and for oil heating coils in the double bottoms, etc. In port this boiler may be fired with the ordinary oil burners.

The large funnel is no mere decoration, but in addition to housing the exhaust silencers it forms the main ventilating shaft from the engine room creating a natural up draft to carry off any gas or oil fumes or heat from engines.

The passenger accommodation and officers' quarters are all electrically heated, and all deck machinery is electrically operated, electric fittings being supplied by the Sunderland Forge & Engine Co. With 16 tubular steel derricks, there is one 10 ton lift, twelve of 6 tons and three of 3 tons. The steering gear is of electric-hydraulic type on the Hele-Shaw principle, utilizing Arctic oil in the piping.

Besides wireless telegraph of the Siemens type, this ship has Siemen's radio direction finder which utilizes an inclosed loop aerial which is turned to obtain the maximum or minimum reception. There is also a device for determining from which end of the line of direction the signals are being received. Capt. D. Buckley who brought the ship out says that he gave the direction finder a good try out coming up the Pacific coast in fog and found it worked well.

Much of the cargo space is adapted for carrying fruit and other perishables, there being 75,000 sq. ft. of refrigerated space. A cold air distribution system is used. Fuel is carried in seven double bottom tanks, and in two wing tanks aft, the total capacity being 1450 tons.

The passenger accommodation, which is limited to 14 on account of the ships classification as a cargo ship, is laid out in a style that challenges the luxurious appointments of a passenger liner. The public

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rooms consisting of a dining saloon, social room and smoking room are most attractively furnished and tastefully decorated, the dining saloon being finished in light oak and furnished with small separate tables. The smoking room is in dark oak with leather upholstered easy chairs, a well filled book case and phonograph. The walls of the social room are finished in old gold and the room is furnished with comfortably upholstered settees, arm chairs, and a piano; while a large mirror with bevelled sections taking up a large section of one wall gives it an air of spaciousness.

Ms. PACIFIC RELIANCE was commissioned on Sept. 9th following her officials trials on which she is reported as making an average of about 14½ knots. On Sept. 17 she left Glasgow for Manchester, sailing from there on Sept. 21 for the Pacific, and arriving at Colon (Canal Zone) on October 7. Stormy conditions were experienced on this run, with north west gales the first three days out. In the vicinity of Bermuda the ship was hove to for 3½ hours on the fringe of a cyclone. Notwithstanding this an average speed of 12½ knots was maintained at an average of 108.5 r.p.m. on a fuel consumption of 17¼ long tons a day for the main engines and 0.7 ton for one auxiliary generator set. The vessel was in light trim with about 1000 tons of cargo.

Sailing from Colon on Oct. 8th after loading bananas there PACIFIC RELIANCE proceeded up the coast calling at Los Angeles, San Francisco, Victoria and Vancouver; Vancouver B.C. where she arrived on October 23 being the turning point of the voyage. On the run up the Pacific Coast Chief Engineer T. Robson reports that she averaged 13¼ knots at 110¼ r.p.m. under moderate weather conditions, though having to slow down occasionally for fog, the fuel consumption being 17 tons 1 cwt. per day for the main engines. The best days' run was 328 miles in 24 hours 20 minutes by observation and 340 miles by the log, the average speed being 14 knots with one engine turning 109.7 r.p.m. and the other 111.8 r.p.m.

The lubricating oil consumption on the trip averaged 24¼ gal. for the forced lubrication system, including oil cooling for pistons which accounted for about 12 gal. per day; besides which an average of 5 gal. of cylinder oil and one gal. of compressor oil was used. A total of 26 tons of lubricating oil are used in the system, with 10 tons reserve storage. An examination of oil in the lubrication system made at Colon showed it to be remarkably clean. Monitor valves on the forced lubrication and cooling water systems are fitted with a whistle alarm safety device which comes into operation should the flow cease.

Up to her arrival at Vancouver no pistons had been drawn for inspection, and only the usual change of exhaust valves made, the used ones being replaced by spares till they were re-ground and put in first class condition again.

Captain Buckley and the Chief Engineer express themselves as well pleased with the operation of the PACIFIC RELIANCE in handling and maneuvering, the engines having a speed range as low as 40 r.p.m. for ordinary purposes, though it is claimed they will work even slower than this. Furness Withy Co. have been operating the Doxford engined motorships PACIFIC COMMERCE and PACIFIC SHIPPER on this run for some time, so when all the new vessels under construction are added to their fleet they will have a strong motorship division of fast freighters. The ship was built by the Blythswood Sb. Co., Glasgow and engined by the Kincaid Co., Greenock, Scotland.

Storage Batteries As a Shipboard Necessity

The Many Uses to Which Storage Batteries Can Be Put on the Modern Motorship Are Not Sufficiently Investigated

By Chief Engineer

AT night when everything has gone wrong aboard ship there is nothing so greatly needed as light. But few of us appreciate its value, importance and convenience. Unfortunately some shipowners deem it necessary to jeojardize human life to avoid excessive investment and perhaps for this reason not every effort is put forth to make light available to the last minute when men are fighting for life after abandoning hope of saving their ship.

Storage batteries present a dependable means of supplying light under the most trying circumstances. No engine can be started to have current available so quickly; no mechanical device is so infallible and there is no available source of electricity for use in emergencies that is at all comparable to them. On the steering gear, too, a storage battery layout affords valuable emergency plant.

But this question of cost always enters and the provision equipment as insurance against accidents the possibilities of which are very remote is not always looked upon with favor by a shipowner. Therefore if we are to have batteries aboard ship they must render a service which will justify the investment. If this can be done the additional factor of safety may be considered as valuable service rendered free of charge. Perhaps we do not fully appreciate what can be saved through having a battery installation, or if no saving is possible how low the cost will be when viewed as cost over and above the investment return.

On one ship of 4000 tons dw. a set of storage batteries was employed in place of an engine, a dynamo and a man at night. The engine room crew was not large and every man was needed for day work in the engine room while the ship was in port and an extra man for this work was made available by lighting with batteries.

While it may be possible to keep one or two night men on the regular routine work of overhauling valves and tightening bearings during their watch on an auxiliary engine, the fact remains that such work is generally done better when supervised by the First Assistant and in most instances more is accomplished.

When it is possible to use a few hours more of the time of the engine room crew it may not be necessary to employ mechanics from shore, although when this saving is considered hour for hour it does not appear great. Actually, however, such a saving is worth while for the engineer does better work in his own engine room than the shore mechanic, not so much as the result of his superior ability, if such he has, but because of his greater interest in the equipment under his care and because he is thoroughly familiar with the tool arrangement and the engine room in general. He knows what he is about, why it should be done, how to do it, and does not have to waste time in devising ways and means or asking questions. Anyone familiar with the cost of obtaining repairs from shore help knows that $1000 does not go far. Yet that amount will carry the investment, depreciation and repair, if any, on a set of batteries, for some time.

While not attempting to make a careful analyses of cost, I wish to call attention to another item. We often find it necessary to bring a wire aboard to supply current to a ship at dock or while in drydock, always in fact, since circulating water for the auxiliary engines is not available while the ship is out of water. Current supplied in this way is expensive as compared to the cost of fuel consumed in an engine driving a generator to charge batteries.

Batteries have been used on tugs and fishing vessels for a number of years. They are charged with a dynamo driven from the main propelling unit and in many instances this arrangement has not only eliminated the inconvenience of having a small engine in constant operation but has actually made such an engine and generator unnecessary. In fact many of these vessels would be seriously inconvenienced if deprived of their batteries. That a system of equal value to larger vessels is not employed is due more to a lack of understanding of the need of such a system than to any inherent fault it may possess.

Maritime law recognizes radio as essential to safety at sea. To render such apparatus available at all times batteries are provided. It is not permitted to tap such batteries for lighting purposes on a ship in distress, but of course this could be done if the occasion justified it. For those conditions when a ship is in serious danger dependable light should be recognized as of equal importance with the radio equipment, yet it is not. We still depend upon oil lamps which are absolutely obsolete. On tank ships they are a serious source of danger. Truly this matter of battery equipment is worthy of notice.

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The New Furness–Bermuda Motorliner

Propelled by Opposed Piston Diesels on 4 Shafts Will Revolutionize Passenger Transportation Between New York and the Island

THE most noteworthy motorship to run trials of recent months is the new Furness Bermuda liner BERMUDA, scheduled to make her maiden sailing between New York and Bermuda early next year. The new vessel combines motorshipping efficiency with a degree of luxury which reaches quite a high level even in these days of luxurious ships. She will revolutionize passenger transportation on what is, in the busy season, one of the most crowded passenger trade lanes.

The propelling machinery which is of novel nature, as far as a passenger ship is concerned, consists of four sets of 4-cylinder Doxford opposed piston Diesels with 24 in. diameter and 41 in. 24 in. strokes rated collectively for 11,200 b.hp. at 110 r.p.m. fitted in the main machinery room. Four Diesel driven generating sets are fitted in the auxiliary engine room, separated from the main engine room by a watertight bulkhead. In the auxiliary engine room two donkey boilers are fitted for generating steam for heating fuel and accommodation, and for cooking purposes. The auxiliaries in the main are electrically driven, as are also the steering gear, capstans, windlass and winches.

There are in all seven decks devoted to passenger accommodation including an exceptionally high promenade deck and dining saloon. A total of 616 first class and 75 second class passengers can be carried.

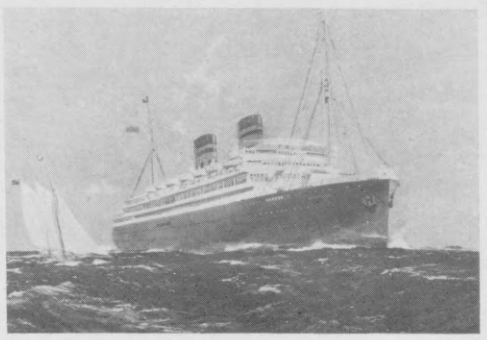
The first class public rooms occupy a considerable space on the promenade and boat decks; also on the upper and main decks, including observation lounge, social lounge with large gallery above, smoking room, verandah cafe, foyer, dining saloon, writing room and library, gymnasium, and a large dancing and promenade space aft of verandah cafe, which can be completely enclosed, or opened up as desired.

The dining saloon, capable of seating over 400 passengers is a lofty apartment running up through three decks with ceiling domes, lit by concealed lights and galleries at the sides supported by alcove piers containing brazier lights. The style of decoration adopted for this saloon is a modern treatment, Grecian in form.

The foyer on the main deck which serves as reception hall on embarkation, is panelled in the style of the late Georgian period, the ornament and decoration being relieved in old gilt. Opening off this apartment is the central bureau, purser's office, chief steward's office and cloak room. Forward of the foyer is the main staircase and elevator, which communicate with all the passenger decks. There are two other similar staircases and elevators, one forward of the saloon for reaching the observation lounge on the boat deck and the swimming bath on F. deck, the third stair and elevator being arranged aft from the smokeroom entrance down to E. deck, and passing through large entrance halls on all the decks between.

Apart from the dining hall and foyer the public rooms are all on A. deck and the boat deck. On A. deck forward there is a library and writing room decorated and furnished in Adams style. Recessed bookcases are formed in between the windows, writing tables, easy chairs, reading chairs, divans and small tables for the comfort of passengers are also fitted. These will be covered alternately with loose covers according to the zone of travel.

The lounge with its orchestral stage and gallery, the domes above, is of the same generous proportions as the dining saloon. It is decorated in the style of the late 17th Century. Large piers, of the height of



Characteristics of Ms. Bermuda

Length b.p.	550 ft. 0 in.
Beam mld.	74 ft. 0 in.
Depth mld.	45 ft. 0 in.
Gross tonnage	17,000 tons
Total power	11,200 b.hp.
Speed of engines	110 r.p.m.
No. of screws	4
No. of passengers	691

three decks support a domed and decorated ceiling while similar columns and pilasters support a galley or mezzanine floor at sides. There is a magnificent parquet floor for dancing in this saloon.

The verandah cafe, approached through the after entrance hall from the smoke room, is to resemble as nearly as possible, an open air loggia or terrace garden. The observation lounge, somewhat similarly treated to the verandah cafe, is approached through the lounge gallery and occupies a commanding position on the boat deck. A large gymnasium on the top deck is set out to supply the needs of all forms of recreation and physical exercises. The walls are panelled in polished teak.

The first class accommodation includes a number of de luxe suites furnished and decorated in various styles consist of a sitting room, bedroom, bathroom and verandah. No less than 70 of the staterooms are fitted with private lavatories. Many of these rooms are arranged for individual accommodation; others are fitted up for two passengers, and in certain cases with provision for a third passenger. The total number of first class cabins is 250.

The accommodation has been specially considered, not only from the point of view of the conditions obtaining on the New York-Bermuda service, which is a luxury and pleasure trip, but also with a view to use on world cruises from 3 to 6 months in duration.

Each stateroom is fitted with mahogany bedsteads, good wardrobe accommodation dressing table, chests of drawers, open type wash basin with running water supply, and full length mirror. The walls are panelled, and colored in various shades, whilst the floors are in designs of ruboleum tiling overlaid with carpet rugs. Each berth is fitted with a reading lamp, which can be full on or dimmed by means of a special switch. The rooms are individually heated and ventilated by a mechanical system, through directional louvres, from which the flow of air can be regulated as desired.

The second class accommodation embraces about 30 staterooms, arranged for two, three or four passengers, with public rooms comprising dining saloon, foyer and lounge.

In view of the intended services of the vessel, special attention has been paid to the provision of spacious promenade and spaces for deck games. The boat deck and the deck below are extended beyond the beam of the ship by as much as 2 ft. 6 in. each side. On the boat deck there is an area of about 70 ft. long by the extended beam for deck sports and dancing, while on the promenade deck below a similar space is provided extending right to the stern of the vessel. A portion of this space has been enclosed, the screen being fitted with large vertical sliding windows, and this space virtually forms a public room. Forward of the spaces mentioned there is a large deck area between the deckhouse and the ship's side available for deck chairs and promenading. The fore end of A. deck, and round the sides for a considerable extent the promenade space is screened in, similar to the dancing space, except that the after end remains open.

Other features of the first-class passenger accommodation include hairdressers shop, information bureau, cinema, and an up to date hospital and surgery are provided. The stateroom corridors are most spacious and access between the various decks is obtained by the handsome and roomy electric elevators and broad and easy staircases.

The service arrangements are on the latest plan; the cooking appliances are largely electrical, and arrangements are made for dining the whole of the passengers at one time, necessitating very extensive equipment in the saloon kitchen and pantry.

Another striking feature of the passenger service is the provision of an extensive up to date steam and electric laundry, which occupies a considerable area on the upper, main and lower decks at the stern of the vessel.

The vessel has been built to comply with the latest requirements of the British Board of Trade, U. S. A. Regulations, and Lloyd's Register. There are nine watertight bulk-

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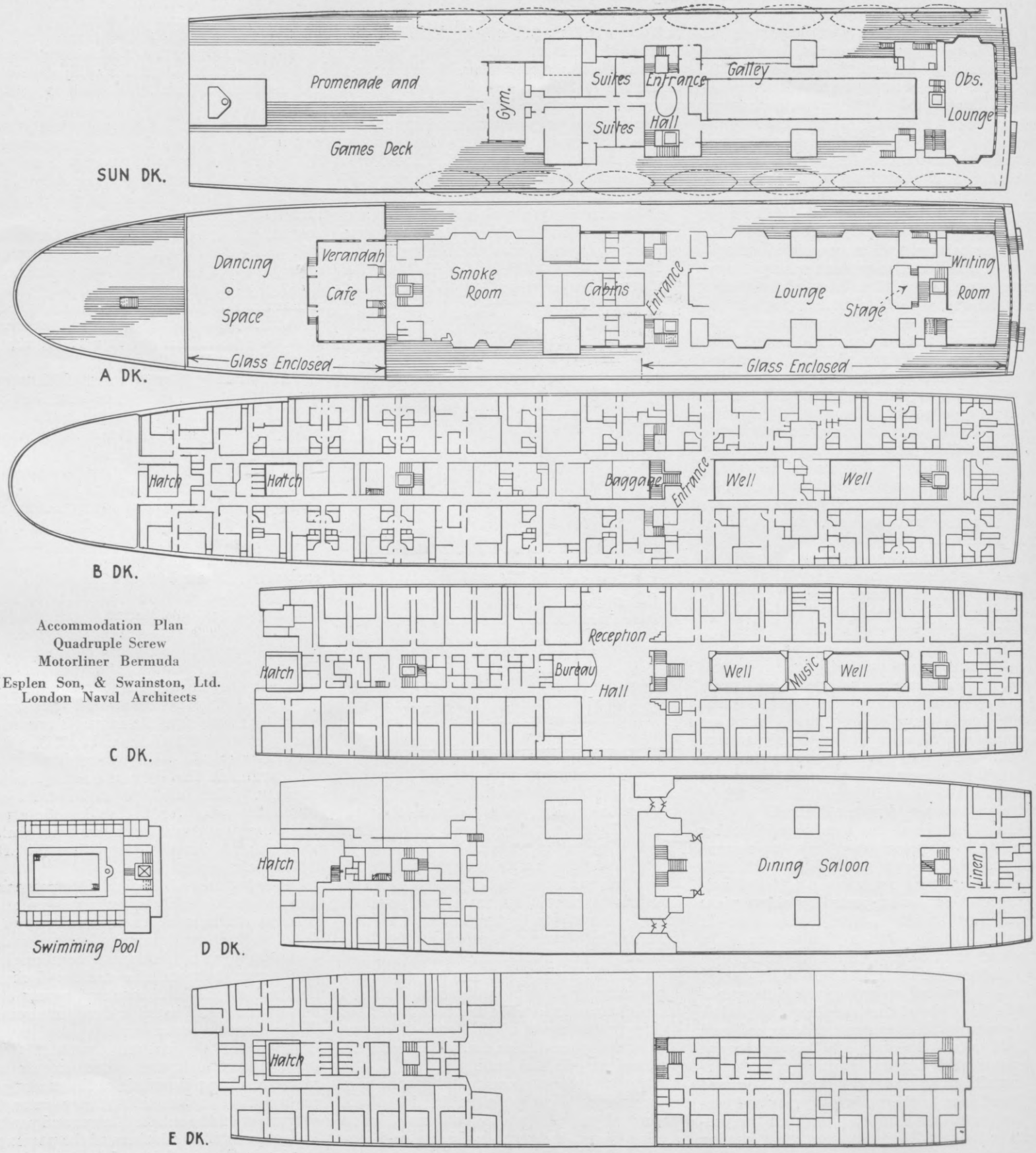
heads, extending to the main deck, the watertight doors being fitted with hydraulic arrangements for rapid closing, and operated from the bridge.

Hydraulically operated steering gear is fitted aft, and to provide power for emergency purposes and for use in port when on board, and in addition a large number of life rafts are placed conveniently on the boat deck. The boats accommodate about 36 passengers each. They are carried in davits of gravity type, which ensures speedy and safe lowering ready for embarking passengers. A large motor boat, fitted with

ated chambers for the carriage of chilled meat, similar chambers for the carriage of fruit and vegetable produce, all as cargo, and also 'tween deck and hold space for general cargo, part of which is arranged for the carriage of motor cars. Another cargo carried will be fresh water for de-



Accommodation Plan
Quadruple Screw
Motorliner Bermuda
(Esplen Son, & Swainston, Ltd.
London Naval Architects

Accommodation layout of the new 11,200 *hp. Furness Bermuda motorliner shows how well the Diesel is suited to clear deck space arrangement*

the generators in the auxiliary engine room fitted in connection with the main machinery may not be working there are two large Diesel driven generators fitted in a separate engine room aft well above the waterline.

Boat accommodation is provided for all searchlight and radio is provided for passenger use, and no doubt this will prove extremely useful at the various ports touched on in World cruising.

Cargo arrangements are somewhat unique. There are insulated and refrigerlivery to the Company's Hotel in Bermuda, and special pumping arrangements are provided in connection with this.

In view of the World cruising arrangements, special requirements have to be met in the provision of large fuel bunkers.

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Big Diesel Ferryboat for Columbia River

The Multnomah, Powered by a 250 Hp. Atlas-Imperial Diesel, Is a Double-ended Craft of Unusual Design

WORK on the hull of the MULTNOMAH, a Diesel-powered ferry being constructed for the County of Multnomah for carrying motor and pedestrian traffic between St. Johns and Linnton across the Willamette River just below Portland, is progressing rapidly and the boat has now received her machinery and equipment. The plans called for completion of the ferry and the first run early in November. The craft, designed by H. F. Gildner, Portland engineer and naval architect, will cost slightly in excess of $54,000. She is a fine modern ship.

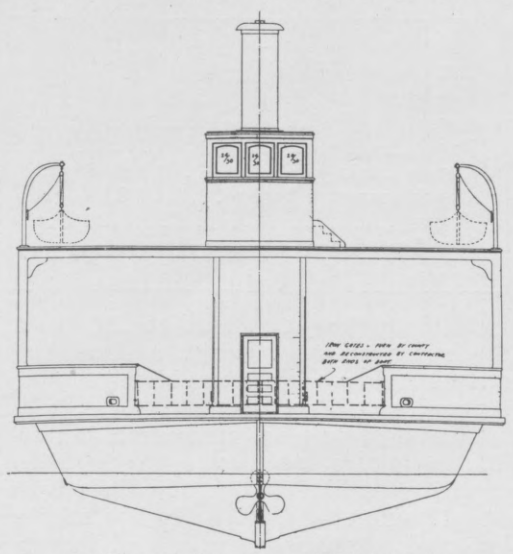
The hull has been constructed by the Supple-Martin Ship Building Company of Portland, and the contract for the engines has been awarded to the Atlas-Imperial Engine Company. The dimensions are 145 ft. 6 in. overall length; extreme beam 44 ft.; depth 10 ft. 7 in. moulded; draft amidships 7 ft. and at the bow ends 18 in.

The ferry is designed for the maximum amount of space for vehicular traffic and is constructed to carry two lines of autos on either side of a center enclosure and one line on the center-line at either end.

Pedestrian traffic has gradually given way to the faster mode of travel until now it is negligible and large passenger accommodations need not be provided. Conveniences for the pedestrian passengers of the MULTNOMAH have, however, not been neglected, though practically all of the deck space is utilized by cars.

In stormy weather when automobile traffic is light, all autos will be protected by the shelter deck over the entire center of the boat. Ordinarily, this protection is not essential for the reason that the trip across the river is of only a few minutes duration; but for the reason that passengers can move about on the main deck in the shelter from the rain they will enjoy a greater degree of comfort. The pilot house is located amidships and on the shelter deck, thereby giving the captain a clear vision of both ends of the boat, and also providing a direct communication to the engine room below. The pilot house is provided with dual steering wheels and equipment, which will facilitate handling of the boat under all conditions.

In designing the ferry a problem presented itself in that several requirements were stipulated which ordinarily would disqualify the use of Diesel engine power. This situation was overcome, however, by the



Outline section shows "V" bottom

adaption of a combination of cut-away bows, full tunnel construction at the ends, and the regular ship's model cut-water stems. To operate successfully under the existing conditions of the river and present landing facilities, the above requirements were met as follows, as stated in the specifications:

"The ferry must be double-ended and capable of nosing up onto the incline runways, which are on a 10 per cent grade to the river, and bring up to the raised pontoons of the slips. (The cut-away bow takes care of this condition for the reason that there is only 18 in. draft at the ends.)

"Propeller wheels must be protected from all drift wood or other debris which is a common menace at certain periods of the season. (The full tunnel construction at the bow ends form a sealed pocket for the propeller wheels and rudders to operate and thereby protects them from injury from this source.)

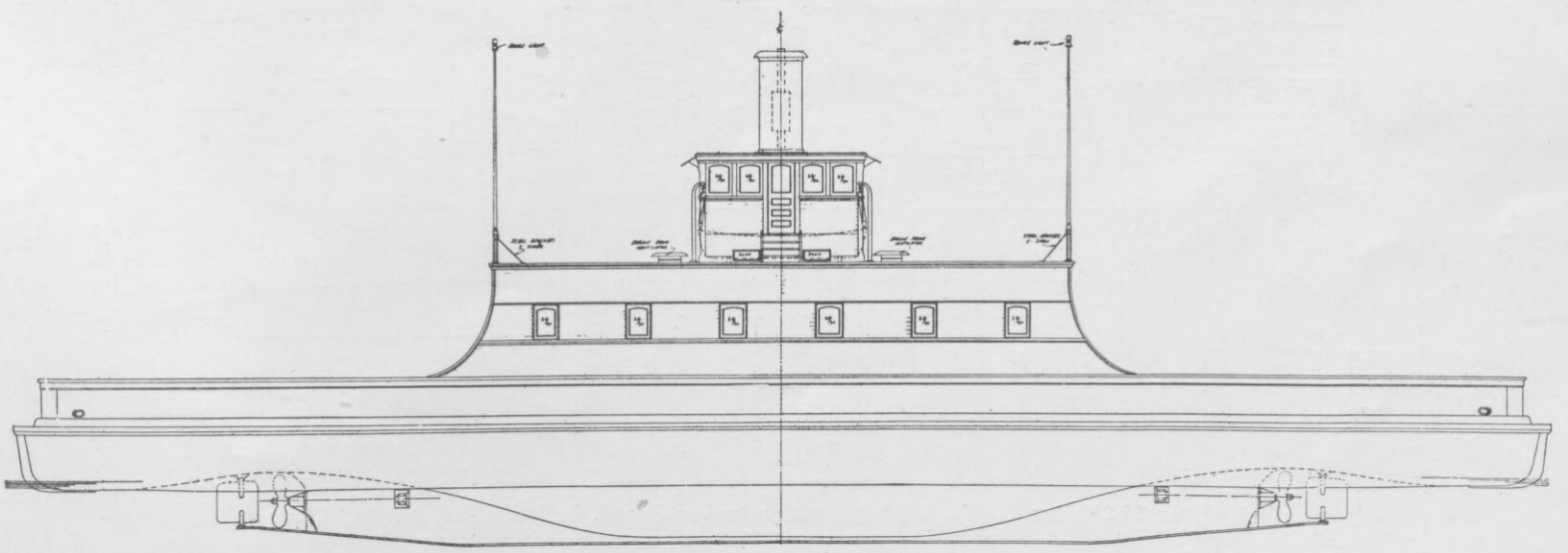
"Speed must not be sacrificed. The adaption of the combination tunnel and regular ships cut water bow together with the easy lines running aft permits the usual speed ordinarily attainable. In order to inspect the propellers and rudders there will be provided sea hatches directly over the high point in the wheel tunnels which may be opened directly to the sea permitting thorough inspection."

The ferry is powered by a 250 hp. Atlas-Imperial full Diesel marine engine, direct reversing and provided with one one-way clutch at both ends, all of which is mounted on a common base.

In this connection the engineer has kept in mind the possibility of one of the propellers going out of commission in which case the remaining wheel can be used in either direction during the emergency. The operation of the ferry will be such that the engine will be operating continuously in the same direction using the clutches to throw in either one of the wheels as desired.

Auxiliary equipment will consist of a 6 hp. gasoline engine directly connected by means of clutches to 3 kw. 110 volt direct current generator on one end and a 2-inch high pressure rotary fire pump at the other end. The usual air compressor will be a part of the engine block and provided with a device to lift the valves when not in use. An electrically operated sanitary plunger pump and tank set for automatic operation will be installed for the sanitary system.

The equipment used for the steering gear consists of the straight hydraulic cylinders and the valve. Pressure water is supplied by means of a direct connected plunger pump on the main engine which delivers a continuous water pressure sufficient to operate the mechanism under all conditions. Should this supply fail, provision is made for utilization of reserve air for delivering the desired water pressure, all of which is automatic.



Ms. Multnomah is an ingeniously designed 250 hp. Diesel double-ended ferry with a draft of only 18 in. at each end

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New Big Motor Tanker for Sun Oil Co.

Sun Sb. Co., Chester, Pa., Completes 13,300 ton Dw. Motorship Powered by a 3,680 I.hp. Sun-Doxford Diesel

MS. SUNOIL completed this month at the Chester (Pa.) Shipyard of the Sun Sb. & D.D. Co., is the largest motorship from the point of view of size to be completed in America since the GULFPRIDE went on service in April of this year. Both ships are tankers and rank among the largest tankers in the world. SUNOIL, as the general arrangement plan reproduced herewith shows, is a single screw ship built on conventional tanker lines with part electric and part steam auxiliaries, there being for this latter purpose an oil fired boiler of 3060 sq. ft. heating surface supplying steam at 220 lb. per sq. in. There is also a single exhaust gas boiler mounted high up in the engine room casing which supplies steam at 125 lb. per sq. in. pressure for tank warming at sea.

Chief interest centers around the single main propelling unit which is a 4-cylinder Sun-Doxford opposed piston Diesel rated for about 3680 i.hp. at 90 r.p.m. Each cylinder has a diameter of 23⅝ in. and each piston has a stroke of 45½ in., the combined strokes thus being 91 in. The scavenge pump is driven off the main crankshaft between each pair of cylinders. The engine weighs about 730,000 lb. complete, with an overall length of 32 ft. 3¾ in. and an overall width of 13 ft. 4½ in. Airless injection of fuel is used and the engine is a well built long stroke slow running prime mover admirably suited to this class of work. Two Sun-Doxford generator sets supply current for the majority of the engine room and deck auxiliaries. The principal steam auxiliaries are those incident to the steam tank-heating boiler, the horizontal cargo pumps, a standby air compressor, an engine room bilge pump and a pump room bilge pump.

Characteristics of Ms. Sunoil

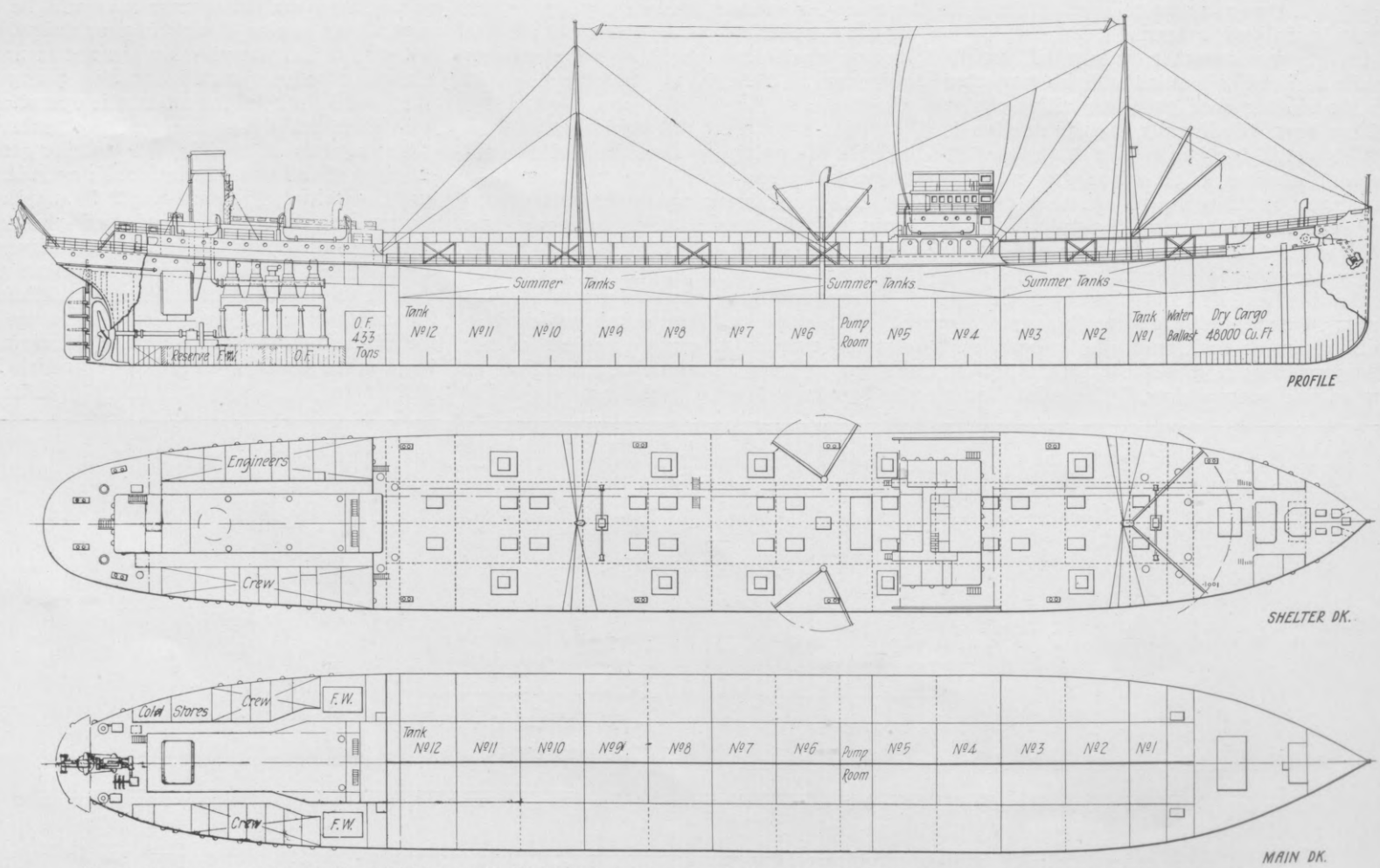
Length b.p.	480.0 ft.
Beam, molded	65.7 ft.
Depth, molded	37.0 ft.
Capac. main tanks	3,908,633 gal.
Capac. summer tanks	893,587 gal.
Power	3680 i.hp.
Number of main engines	1

Like the majority of modern tankers, MS. SUNOIL is constructed on the Isherwood longitudinal system. In the conventional manner, she has a single centerline bulkhead, expansion trunks and summer tanks. The total capacity of the main tanks is 3,908,633 gal., while that of the summer tanks is 893,587 gal. The vessel has a nicely modeled cruiser stern and this with a large raking stack set well aft in the engine casing and two correspondingly raked masts give the ship quite an appearance of power.

As far as the stern is concerned, however, chief interest centers round a device which has been specially fitted to improve the ship's propulsive efficiency. This is the Oertz streamline rudder*, an efficiency device recently introduced into the United States by Wm. Braat, New York, who is president of the American company.

The principle on which the construction of this rudder is based has been derived entirely from experience in aviation, viz., that a comparatively thick wing profile gives the best proportion between lifting power and resistance in longitudinal direction. It is claimed that when applied to the rudder of a ship this means the greatest possible steering effect with the smallest possible resistance. In order to retain this favorable wing profile, at extreme angles of helm, Dr. Oertz, designed his rudder in two parts, parabolically rounded forepart constructed as a fixed guide body around the existing rudder post, or in new construction completely replacing the old rudder post, and an afterpart of the rud-

*See MOTORSHIP, September, 1927.



General arrangement of the 13,300 ton D.-W., 3,680 hp. motor tanker Sunoil, built by Sun Sb. Co., Chester, Pa., for the Sun Oil Co., Philadelphia. She is one of the most important ships completed in an American yard this year

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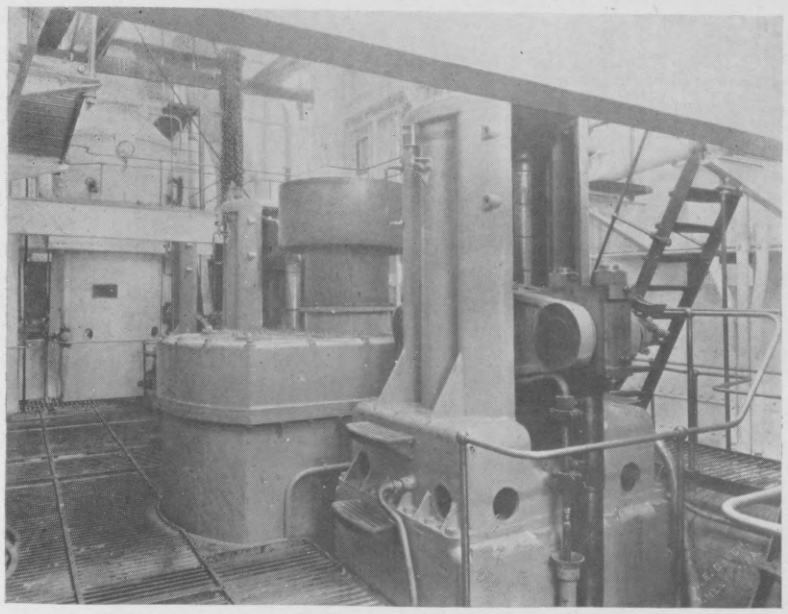
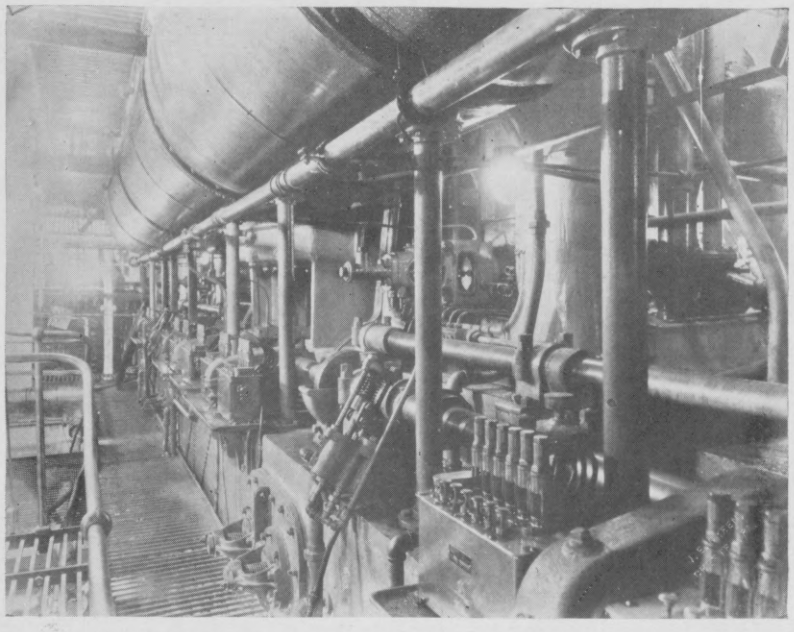


Cylinder tops of main engine with scavenge pump



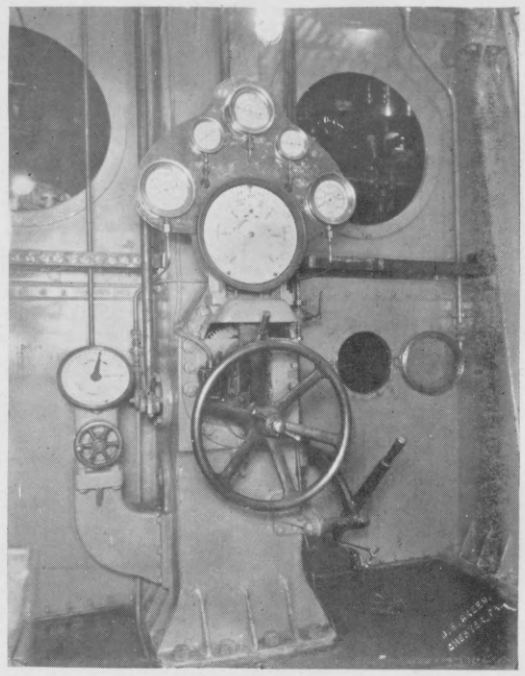
Back of main Sun Doxford Diesel at mid platform level

An Oertz steamline rudder is fitted to reduce power required for steering

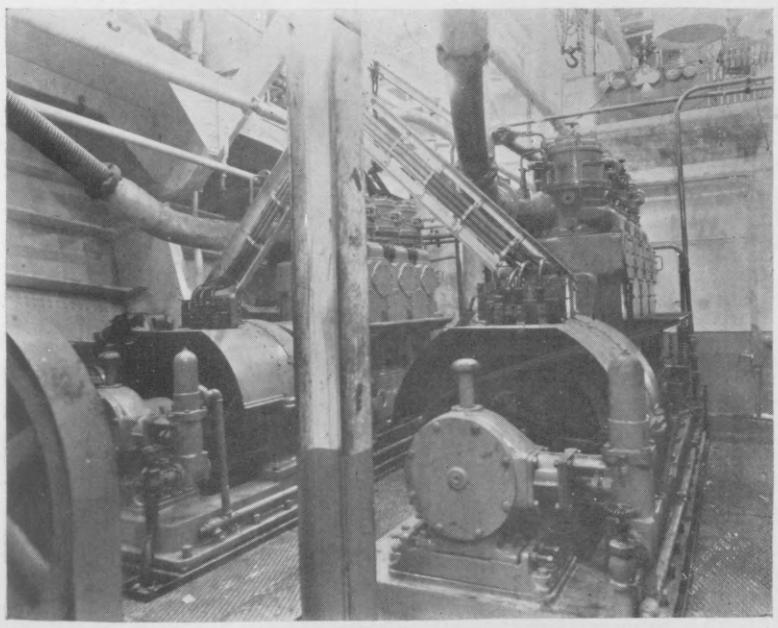
der, the actual rudder or "turning" part, joining the fixed forepart in a complete streamline form.

The turning axis of the movable back part lies at about 1/3 of the total length; consequently, a distribution of pressure is obtained, resulting in a favorable turning moment. This rudder construction is said to require only 50 per cent to 70 per cent of the steering power needed for a normal plate rudder of the same dimensions. Through this two-part construction, not only is the ideal streamline profile retained at every helm angle but also, as the fixed parabolically rounded forepart always takes up the propeller stream in the center line of the ship, the propeller stream is so completely levelled that the wake is extremely smooth behind the ship. Another of the features claimed for this two-part rudder construction is the fact that the ship is retained steady on its course practically without yawing.

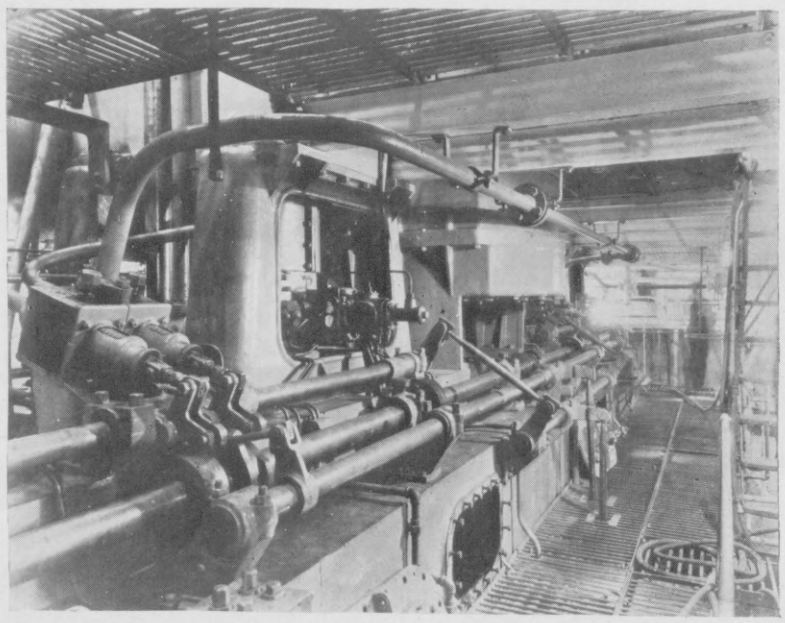
The rudder can be applied to single-screw as well as to multiple-screw vessels. The conversion of an ordinary plate rudder into an Oertz rudder can be made very easily.



Control position for main engine on bottom platform



Two Sun auxiliary generating sets on engine room floor



Cam shafts at mid platform level on engine front

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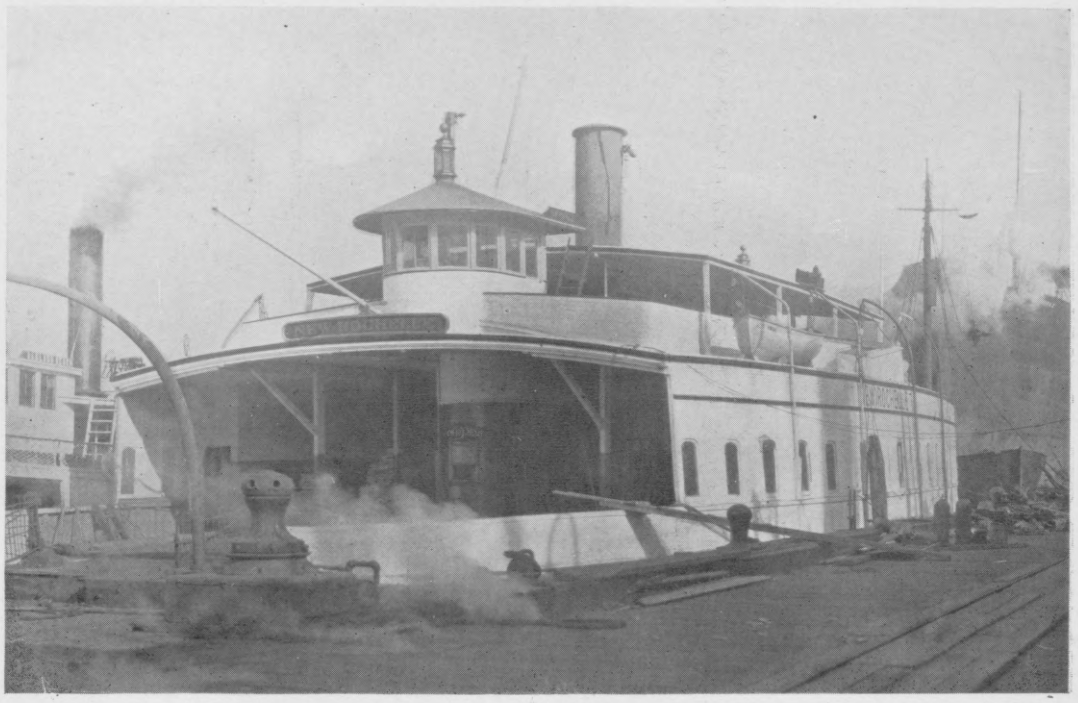
Winton-Engined Ferryboat for Long Island Sound

Interesting Conversion on Wooden Sidewheeler Carried Out by New York Harbor D. D. Co.

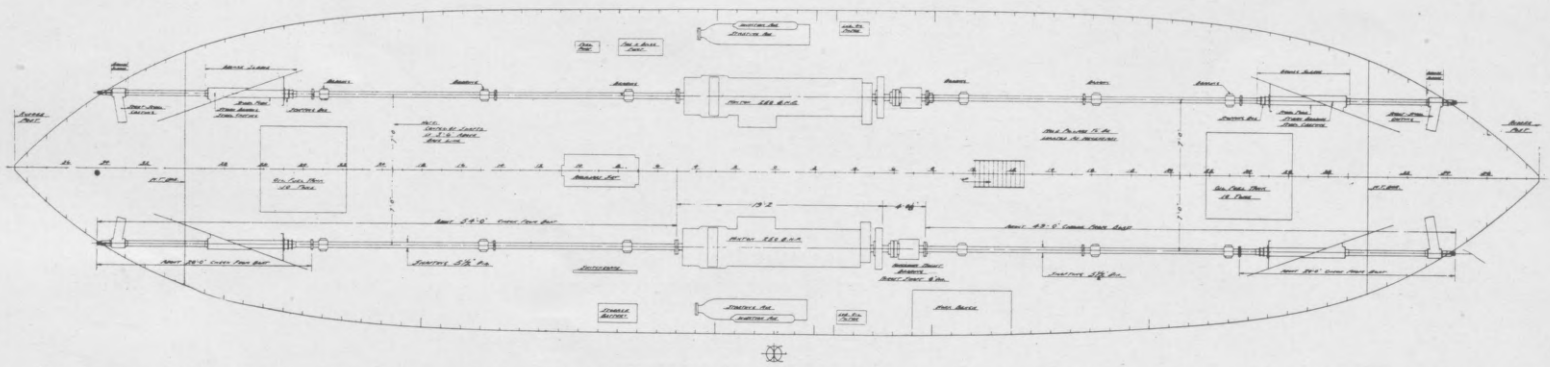
NEW YORK HARBOR DRYDOCK CO., Staten Island, has recently converted the ferry, NEW ROCHELLE, from a steam side-wheeler into a modern Diesel-propelled screw ferryboat. The vessel now has twin-screw, straight-through drive, as the machinery layout shows, each pair of propellers being connected to a 6-cylinder, 250 b.hp. Winton Diesel. She was formerly named COLUMBIA.

NEW ROCHELLE is intended for automobile-carrying work across Long Island Sound. She is an old Philadelphia-Camden ferry with an iron hull, which, today, is in excellent shape. Built in 1877, she has a length of 141 ft., a beam molded of 30 ft., and a depth of 7.7 ft.

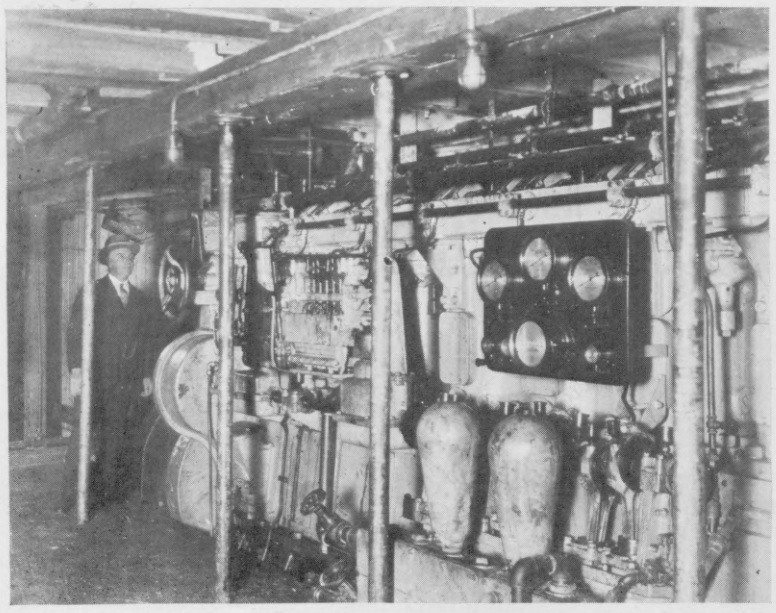
Conversion work in the ship has included the cutting down of part of the wooden upper structure, building of a passenger shelter on the superstructure top, with the necessary stairway. Part of the original "Men" and "Women" cabins on either side of the main deck, have been retained but made narrower. Ms. NEW ROCHELLE is a fine job and should perform very useful service. She has been converted under the supervision of Tams & King, naval architects, New York.



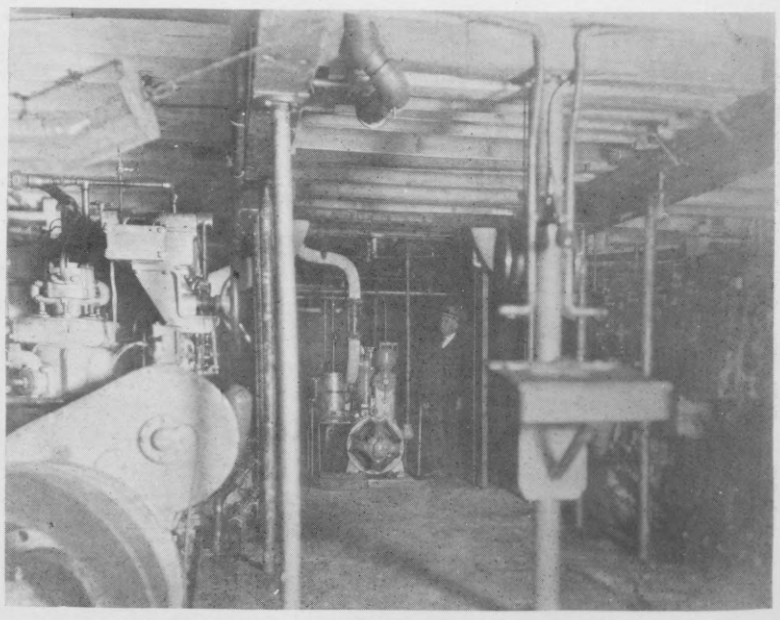
Built 50 years ago, her iron hull in excellent condition, the ferryboat New Rochelle has been modernized by a Winton-Diesel installation of 500 hp.



The modern machinery layout installed in the ferryboat New Rochelle comprises two 250 hp., 6-cylinder, Winton-Diesels, with straight-through shaft drive



Control position of one of the two 250 hp. main engines



Looking between the two main engines showing a Cummins' engine-driven auxiliary set

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The Trend of Marine Oil Engine Design—2

A Discussion of Features Affecting the Limitations of Cylinder Sizes and Powers in Various Types of Engines

HIGH power propulsion units for motorships can be obtained either by increasing the number of cylinders and using electric or gear drive or by making each cylinder larger in size. This article will deal with the limits to the progress possible in the latter direction, using the materials that are at present at our disposal.

The limitation of cylinder size is imposed by the heat stresses set up in the materials surrounding the combustion space. The cylinder cover and piston can, in certain types of engine, be designed to allow a modification in shape when they are subject to heat flow, and in this way it is possible to reduce the stresses which it causes to a minimum value. The cylinder liner is of a fixed and rigid form and it is here that the limitation to the size of cylinder is to be expected. What then are the factors that must be known before the heat stresses can be calculated?

1. It is evident that the rate of flow of heat per unit of surface must be estimated.
2. The conductivity of the metal must be known in order to determine the drop in temperature which will be caused by the heat flow.
3. The modulus of elasticity of the material must be determined.

We will first consider how the rate of heat flow is likely to vary with different sizes of engine. When fuel is burnt some of the heat is lost immediately to the cylinder walls by direct radiation during combustion, the remainder of the heat raises the temperature of the air in the cylinder and some of it is transfered to the cylinder walls by their direct contact with the hot gases. It is evident that the heat transfer by direct contact will vary directly with the surface exposed but that the loss due to radiation from the flame will vary with the quantity of fuel burnt. The quantity that we want is however heat flow per unit time so that, as we reduce the revolution speed of large engines to keep the piston speed constant, the quantity of fuel burnt and therefore the heat transfer due to radiation will vary with the area of the piston and consequently with the surface exposed. It will be seen from this that both factors causing heat flow to the wall vary with the surface exposed so that for any size engine of a particular type the average rate of heat flow in K cal/m²/hr will be approximately the same. Another factor in heat flow is the cyclical variation. This depends on the amount of heat per revolution and will increase greatly as revolution speed is decreased. Almost the whole of the heat is given off during the combustion period. That is, radiation varies as T^4 and conductivity as T so that it will be readily seen that the rate of heat flow is many times greater during combustion than at any other time during the stroke.

Some two years ago, in a paper read before the Institution of Naval Architects, Mr. Robert Sulzer published a great deal of information on this subject as a result of mathematical and test bed research. In this paper it was shown that the mean value of heat flow was 160,000 K cal/m²/hr and that there was a surface variation of temperature of about 20 deg. C. for a 2-cycle engine 600 mm. bore x 1060 mm. stroke. In practice some parts of the combustion space are subject to more severe conditions due to the uneven flame distribution during combustion, so that for calculations of the limiting conditions we must allow for heat flow up to a maximum rate of about 200,000 K cal/m²/hr, and for a temperature variation at the inner surface of about 35 deg. C.

Cast iron and steel are the only materials at present available suitable for cylinder construction, so we will use the conductivity of these materials as the basis for calculations. The value for the conductivity for either material is approximately 5300 K cal/m²/cm/deg. C./hr. so that with a heat flow of 200,000 K cal/m²/hr. we may expect a temperature gradient of 37 deg. C. for cm. thickness of metal.

The stress resulting from this heat flow is evidently due to the restrained form change of the material which will produce a tension stress on the cold side and a compression

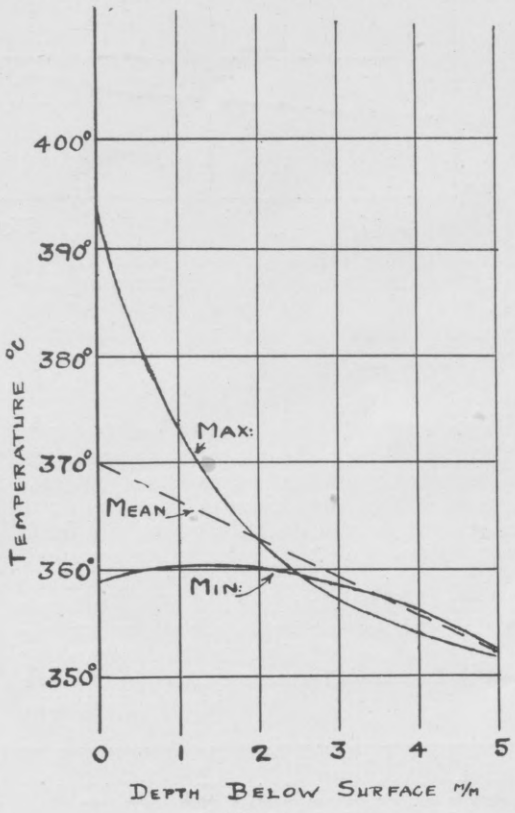

Fig. 1

stress in the hot side, with no stress at the centre. Superimposed on these will be additional stresses resulting from the variation in mean temperature along the liner, but the latter stress will, in general, be of comparatively small magnitude.

Assuming the modulus of elasticity of the material to be approximately equal in tension or compression, the stress at gas and water sides will be:

$$ft = fc = Ee. \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where ft = tension stress at water side
fc = compression stress at gas side
E = modulus of elastically of the material
e = half the expansion that would be caused in unit length by the difference of temperature between water and gas sides if the metal were free to expand.

$$\text{It is evident that } e = \frac{(T_1 - T_2)\,Ce}{2} \quad \ldots \quad (2)$$

where T_1 & T_2 = temperature at gas and water sides of the metal.
Ce = coefficient of expansion of the metal, therefore, becomes

$$ft = fc = \frac{E\,(T_1 - T_2)\,Ce}{2} \quad \ldots\ldots\ldots \quad (3)$$

We have shown that the temperature drop through the wall at the parts subject to the greatest heat flow is about 37 deg. C. per cm. It follows that $T_1 - T_2 = 37t$ where t = thickness in cms. of the wall so that (3) becomes

$$ft = fc = \frac{E \times 37t \times Ce}{2} = 18.5\ E.t.\ Ce \quad \ldots\ldots \quad (4)$$

evaluating E and Ce for cast iron and steel becomes

for steel
$$ft = fc = 5t \text{ kgs./mm.}^2$$
for cast iron
$$ft = fc = 2.3t \text{ kgs./mm.}^2$$

The above figures give the mean value for heat stress at the inner and outer wall throughout the stroke but at the inner wall an additional stress due to the cyclical temperature variation must be added. The run of the temperature gradient through the surface layer of the wall at the times when it reaches its maximum and minimum values are shown in Fig. 1. The maximum occurs at a point near the end of the combustion period, while the minimum is towards the end of the compression stroke.

These curves show that the stress at the

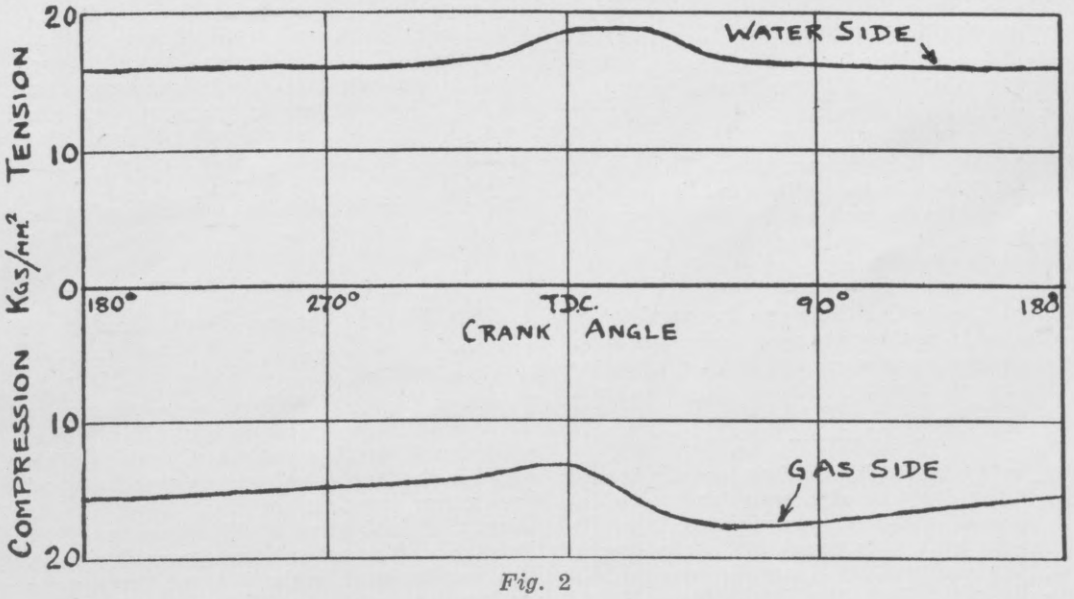

Fig. 2

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inner wall has a maximum value:
for cast iron
3.0 kgs./mm.² above the mean value
for steel
6.5 kgs./mm.² above the mean value
while the minimum stress is:
for cast iron
1.4 kgs./mm.² below the mean value
for steel
3.0 kgs./mm.² below the mean value

This variation in compression stress at the inner surface is accompanied by a negligible variation in the tension stress at the outer surface of the metal.

Added to the tension at the outer surface and subtracted from the compression at the inner surface is the stress caused by pressure in the cylinder which varies from about 2.6 kgs./mm.² to zero, for cast iron, and about 3.6 to zero, for steel, due to the somewhat thinner construction that may be used with the latter material.

The curve in Fig. 2 shows the variation in the total stress, throughout a revolution, at the inner and outer surfaces of a cast iron liner 7 cm. thick. Fig. 3 gives similar curves for a steel cylinder liner of material 5 cm. thick. These curves represent approximately the conditions that would arise in a 2-cycle engine having cylinders 1000 mm. bore and 1450 mm. stroke running at 100 r.p.m. and developing about 1500 i.hp. With so considerable a stress variation, as is evident from the diagram, the maximum stresses must be kept appreciably below the limit of proportionality of the material. In the case of the steel cylinder the limit of proportionality will be about 31 kgs./mm.² and as will be seen this limit is almost reached in the case considered so that the cylinder would probably fail due to fatigue of the material after a short period in service. The cast iron used in Diesel engine cylinders will have a limit of proportionality of about 23 kgs./mm.² in tension and about double this figure in compression (i. e. the limit of proportionality is very close to the ultimate strength). The stresses shown in Figs. 2 and 3 are somewhat lower than these figures in that the size of cylinder suggested might be reasonably capable to stand a considerable period in service without failure although it is approaching the safe limit of size. Throughout the above calculations the figures for heat flow have been assumed at a somewhat higher

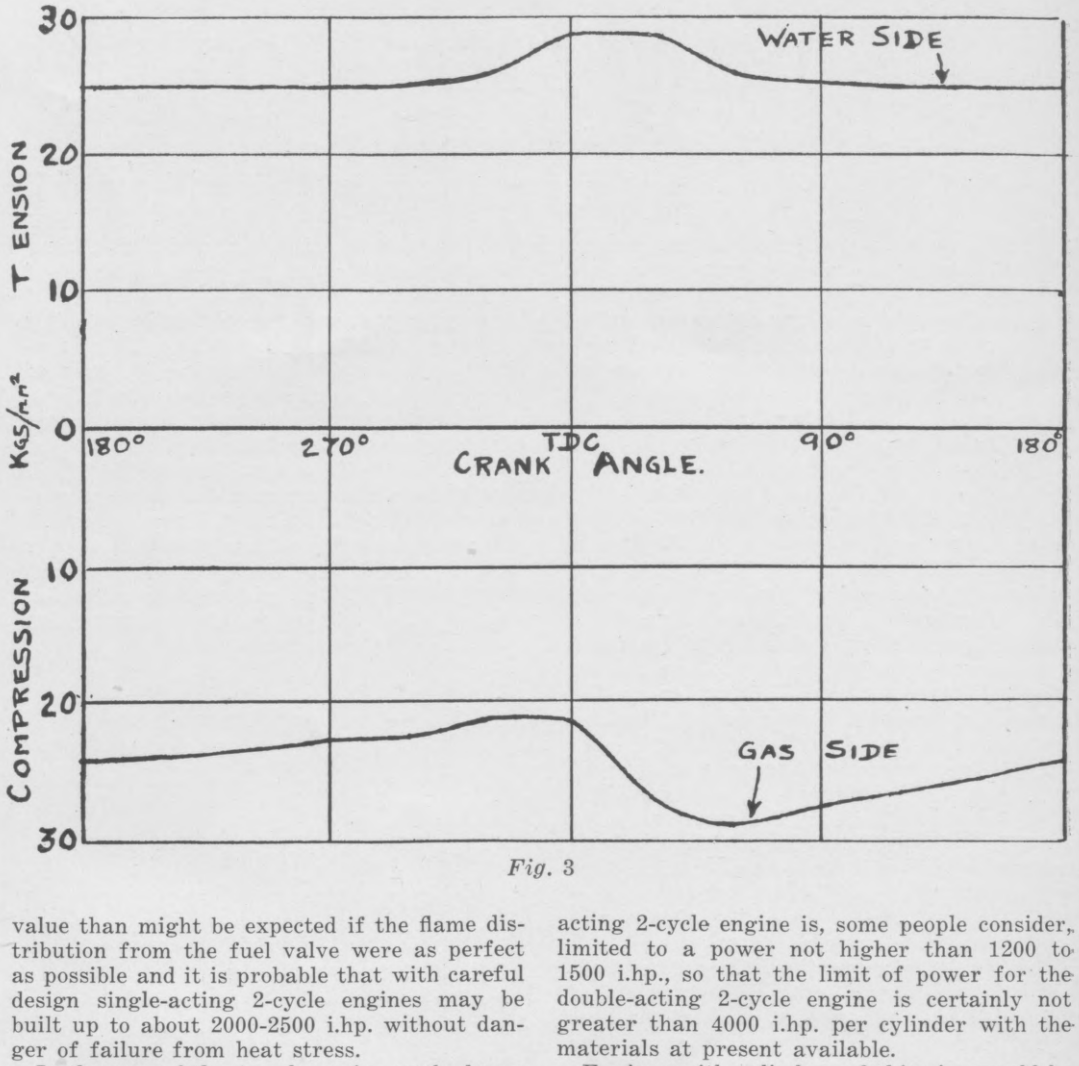

Fig. 3

value than might be expected if the flame distribution from the fuel valve were as perfect as possible and it is probable that with careful design single-acting 2-cycle engines may be built up to about 2000-2500 i.hp. without danger of failure from heat stress.

In the case of the 4-cycle engine or the lower end of a 2-cycle double-acting engine the cover design may become complex so that heat stresses higher than those of the lines are caused. These will limit the power to a much lower figure in a single cylinder than that calculated above. An exact calculation of these stresses is impossible, but the limit, in some people's opinion, for the 4-cycle engine is probably about 800-1000 i.hp. for the single-acting unit and somewhere around 2000 i.hp. for the double-acting unit. The lower end of a double-acting 2-cycle engine is, some people consider, limited to a power not higher than 1200 to 1500 i.hp., so that the limit of power for the double-acting 2-cycle engine is certainly not greater than 4000 i.hp. per cylinder with the materials at present available.

Engines with cylinders of this size would be capable of developing sufficient power to meet the requirements of a passenger liner such as the LEVIATHAN or MAJESTIC, but their weight would be somewhat excessive for use in a modern battleship. In fact, it is doubtful whether justification can at present be found for the construction of such engines in view of the great advantages of the alternative scheme of using multiple high speed units in conjunction with electric drive. The next year or so will show many developments.

Many Engines Ordered

Three weeks ago Charles Ward Engineering Works completed the Diesel-driven stern wheeler F. H. HILLIARD for the U. S. War Department. She is equipped with a 220 b.hp. Bethlehem Diesel engine and one Hill 23 kw. auxiliary set.

Eads Johnson, New York City, has placed an order for a 500 hp. Nelseco-Diesel for conversion of the Singer Sewing Machine Co.'s steam lighter DOUGLAS ALEXANDER.

George Gibbs, Jacksonville, Fla., is building six Diesel ferries, each equipped with two 100 hp. Fairbanks, Morse engines. This order totals 12 engines in all.

Winton Engine Co., Cleveland, has received an order for 16 engines for nine motoryatchts including two engines of 400 hp. for replacing the present smaller engines on the yacht GUINEVERE.

Bessemer Gas Engine Co. has recently booked orders for five sets of Diesels for yachts, including a pair of 1500 hp. units, for Ernest B. Dane, Boston. This vessel, 240 ft. in length, has been designed by Henry Gielow and will be built by the Bath Iron Works, Bath, Me

Lack of Modern Ships Hamper U. S. Coast and Geodetic Survey on Atlantic Coast

Notwithstanding some outstanding accomplishments on the Pacific coast, in Alaska, and in the interior of the United States during the past year, the U. S. Coast and Geodetic Survey is backward in its work on the Atlantic Coast, according to Colonel E. Lester Jones, Director, in his annual report. Colonel Jones says: "On the Atlantic Coast we are backward, owing to the fact that we have not the up-to-date ships to meet the demand as it is being met on the Pacific Coast.

"The failure to authorize a new ship for the east coast is unfortunate. The need of this vessel is urgent."

The World's Largest Diesel Dredge

The Diesel-driven dredge NEW JERSEY recently completed for the Great Lakes Dredge & Dock Company, Chicago, has been placed in service on Lake Michigan in connection with the vast water-front development in Chicago. This vessel is the largest of her type ever built and her power consists of four Busch-Sulzer Diesels of 1150 b.hp. at 180 r.p.m. and two Fairbanks, Morse auxiliary generating units. She was designed by the Bucyrus Company in conjunction with her owners and James Polhemus of the Port of Portland, and was built at the Manitowoc Shipyard. James H. Polhemus was the designer of the CLACKAMAS, which now becomes the world's second largest Diesel-driven dredge. Full particulars of the NEW JERSEY *will shortly be published in* MOTORSHIP.

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